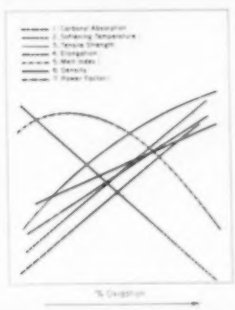
MARCH 1960

PLASTICS TECHNOLOGY

THE MAGAZINE OF APPLIED ENGINEERING

Clay-Filled Reinforced Plastics

Oxidation in Extrusion



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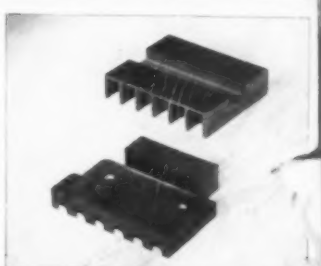
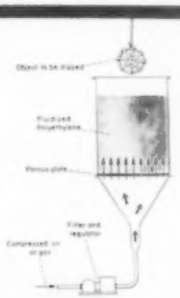
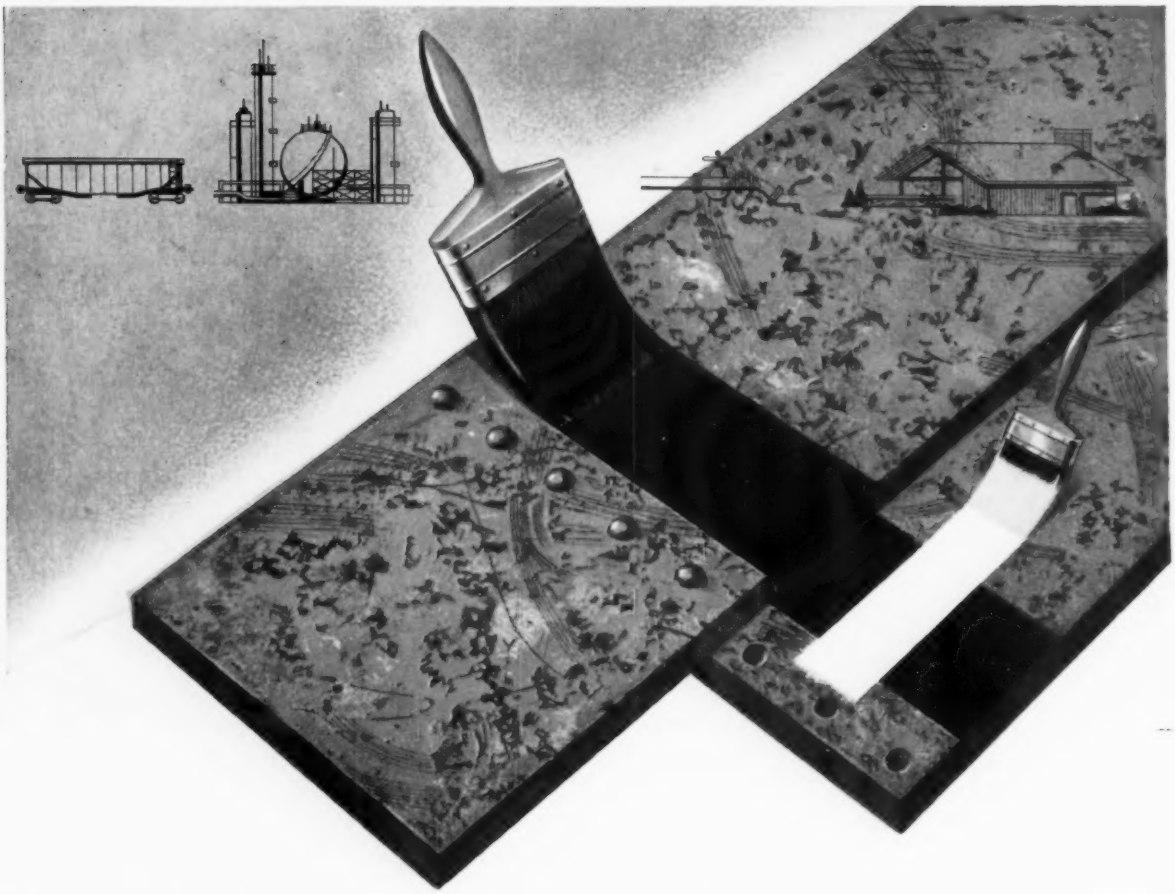
P&E

Fabricated Molds



Fluidized Bed Coating Techniques





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PLASTICS TECHNOLOGY

THE MAGAZINE OF APPLIED ENGINEERING

March 1960, V. 6, No. 3

feature articles:

oxidation in extrusion ..... p. 31

by R. C. PHELPS and R. F. KOWAL

Factors leading to excessive oxidation in extrusion are shown to be numerous, and to be due mainly to inadequately-designed equipment and improper operating conditions. In the first category are screw design, streamlining of polymer flow, choice and location of temperature-controlling devices, and properly-rated heaters. Improper operating conditions can result in gels or fisheyes in blown or flat films, and pimple-like imperfections on heavier extrudate sections. The use of inert-gas blanketing of polyethylene extruder feed is mentioned, together with its role in preventing excessive oxidation during extrusion.

fabricated (built-up) molds ..... p. 34

by CARL ZEHR

Low-bulk, low-pressure glass/polyester molding materials offer new possibilities in product design and mold construction. Advantages of fabricated molds are given in comparison with costs for conventional high-pressure molds. Examples of three current applications for the new mold technique are described in detail.

clay fillers in structural reinforced-plastics-parts ..... p. 40

by C. C. LUCE

In manufacturing reinforced-plastic auto bodies, boat hulls, and trays, the MFG Companies are faced with rigid physical-property specifications to meet their customers' requirements. Rather than using fillers merely as extenders to reduce resin and product costs, without excessive degradation of the products, the companies use clay-type filler materials to improve the physical properties of the resulting parts.

guest editorial:

plastics automotive applications and tooling ..... p. 38

by W. P. GOBEILLE

engineering forums:

reinforced plastics ..... p. 46

by HARRY T. DOUGLAS

Gun fight at the reinforced-plastics corral.

moldmaking & tooling ..... p. 47

by MAX WOHLLEBEN

Mold surface finishes and their standards.

compression & transfer molding ..... p. 48

by PAUL E. FINA

A data sheet — what ho!

exploring fabrication techniques:

diallyl phthalate, powdered polyethylene ..... p. 44

by L. J. ZUKOR

feature stories:

gooch replaces johnson on p.t.'s editorial advisory board ..... p. 39

the car of tomorrow ..... p. 37

dacron reinforcement improves prosthetic devices ..... p. 43

feature departments

4 Letters to the Editors

7 Previews of Next Month

16 What's New in Processing

22 This Month in Brief

25 Editorial

50 News of the Industry

52 Names in the News

54 New Materials

59 New Equipment

64 Plastics Applications

69 Book Reviews

70 Patent Digest

72 Article Abstracts

74 Calendar of Coming Events

74 Current Market Prices

75 Production & Sales

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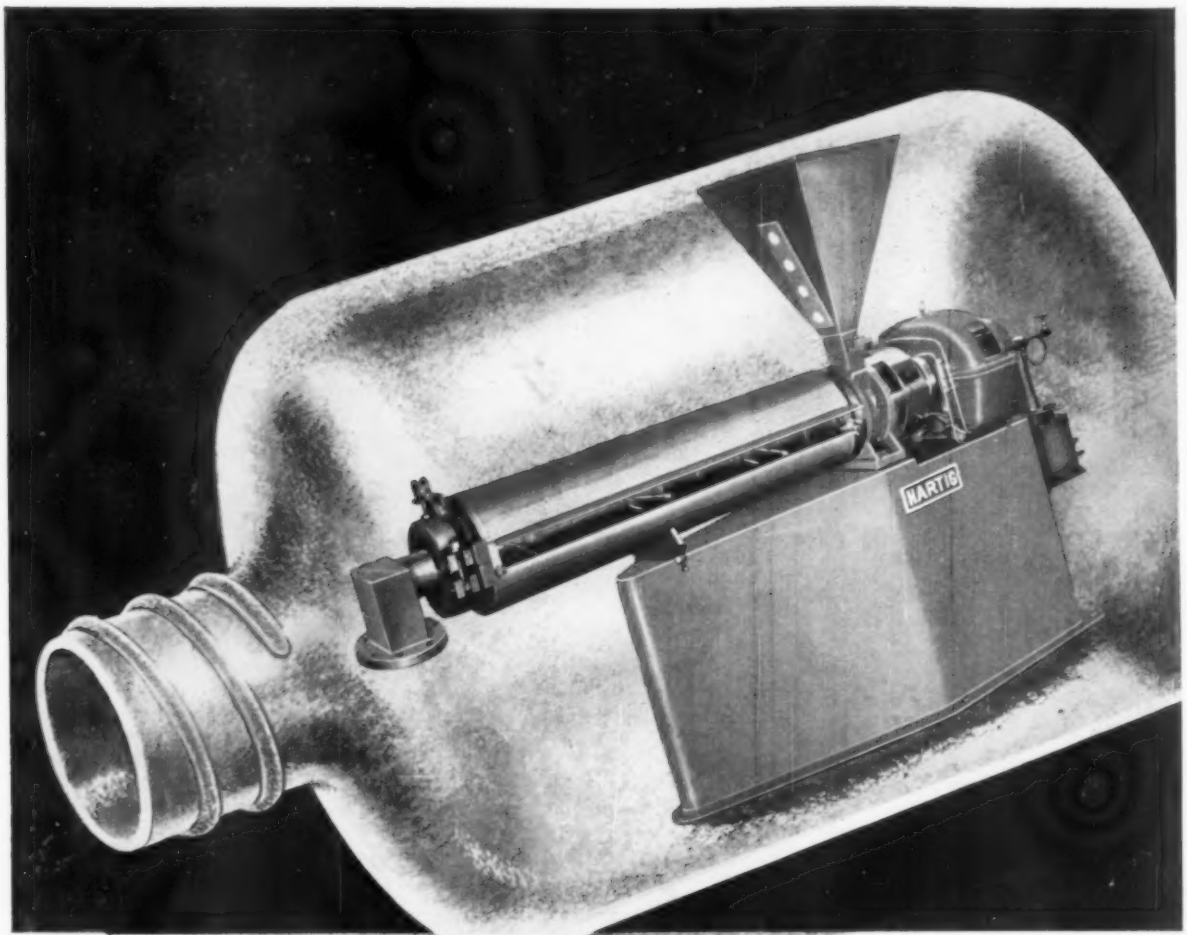

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You'll be interested in the new Waldron-Hartig Bulletin LF-1 which gives the story on our laboratory facilities available for experimental and pilot plant studies. Write for your copy.

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Letters to the Editors

Quick R-P Shelters

Dear Sirs:

Several weeks ago, there appeared in the Providence, R. I., newspapers an article in which I am very interested. However, I could not obtain any additional information from the newspaper library because of limited data.

There is a process and/or application by a company that puts up shelters by this method; a canvas or flexible material is inflated to a predetermined size, such as the shape of an igloo. A site-mixed material is applied by spray over the inflated shape and, after a period of time, hardens into a solid, non-flexible structure. The flexible material is then deflated, leaving the non-flexible structure.

Would you please supply me with the name of this concern.

E. J. Marteka
The Tremco Manufacturing Co.
Cleveland 4, Ohio

(A paper, "An Air Force Approach to Reinforced Plastics Shelters," by A. F. Gordo, J. M. Schramp, G. J. Stabler, and J. E. McCormick, was presented in Chicago, Ill., at the recent SPI Reinforced Plastics Division Conference. A reprint of this paper can be obtained from the SPI office.—Editor.)

• • •

Liked Titeflex Story

Dear Sirs:

We would like to reprint the story which appeared on Pages 58-59 of the December 1959 issue. This article concerned fabrication of a flexible hydraulic hose by Titeflex, Inc. We would publish this material in a News Letter which is distributed only within the company to various plant groups.

R. L. M. Rice, Standards Section
Engineering Department,
E. I. du Pont de Nemours & Co.
Wilmington 98, Del.

(The article in mention appeared in Exploring Fabrication Techniques. The Titeflex hose was entered in the competition on 1958-1959 Achievement Awards in Plastics Technology, and was awarded first prize in Class II (fabrication) as described in our January 1960 issue, pages 48-51.—Editor)

• • •

Plastic Rulers

Dear Sir:

We are looking for the names and addresses of a few leading manufacturers of plastics rulers, particularly foot-long rulers, that are used in schools.

We would be grateful if you would supply us with a few such names and addresses, particularly the one that makes a 12-inch plastic ruler on which is stamped, Admiration, U.S.A.

A. W. Milne
Imperial Research
Islington, Ont.,
Canada

(While no record is available of the manufacturer of "Admiration, U.S.A." rulers, Lee Zukor, our Engineering Editor, was able to suggest four makers of plastic rulers: Sanders Mfg. Co., So. Nashville, Tenn.; B.B.B. Plastics Products, Keyport, N. J.; Sterling Plastics, Union, N. J.; and M. E. Moss & Co., Hartford, Conn.—Editor)

• • •

Wants Company Address

Dear Sirs:

Would you be so kind as to forward this letter to the Jackmeyer Corporation. We would like to receive all pertinent data on the new process which they have developed on the pressure-sensitive blister, Magi-Stick Blister Pac.

Frank Pensado, Mgr.
Plastic Fabricants,
Division of The
Woodman Co., Inc.
Decatur, Ga.

(The article in mention appeared in the page, What's New in Processing. As requested, this letter has been forwarded to Jackmeyer Corp.—Editor)

We invite letters from our readers for publication in these columns. Such letters may be of comment or criticism, requests for information, or of general interest. The only requirement is that all letters must be fully identified as to name of sender, company affiliation and address.

A letter will not be printed if publication is not desired by the sender, and the identity of the writer will be withheld, if desired.

—The Editor

topic for conversation...

GENERAL TELEPHONE SELECTS FORTICEL

How do you improve a masterpiece of function like the telephone? One way is to add color, and thus turn it into a thing of beauty as well. ■ That's what General Telephone has done for the benefit of its millions of subscribers—selecting Celanese Forticel to create the transformation. ■ Color is but one of the advantages that Forticel brings to precision products such as the telephone. This superbly-surfaced plastic is also tough and form retentive. It molds beautifully and fast, and it is free of objectionable odor. Manufacturers and product designers who have used Forticel have discovered its many superior characteristics. ■ Celanese Plastics Company, a Division of Celanese Corporation of America, Dept. 143-C, 744 Broad Street, Newark 2, New Jersey.

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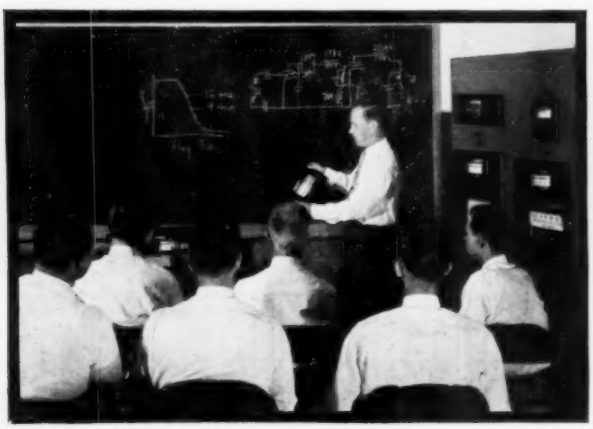

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PREVIEWS

of Next Month

The April issue will feature the following articles:

Stabilization of Vinyl Copolymer Resins. D. A. Knowles, Product Mgr.—Vinyl Stabilizers, The Harshaw Chemical Co., Cleveland, Ohio.

Results are given for a test program involving vinyl chloride-vinyl acetate and vinyl chloride-vinylidene chloride copolymers and two modified PVC formulations. Stabilizers tested in the program were barium-cadmium, lead, tin, and epoxy types. The complexity of the program and proper interpretation of test results are stressed, together with the need for processors to investigate results in his individual formulations.

•

Polyethylene Copolymers. D. A. Jones, Sales Development Engr., Celanese Plastics Co., Newark, N. J.

This new class of olefin resins is discussed, covering chemistry of the materials, their properties and their influence on processing characteristics, and their suggested fields of applications. Differences between polyethylene copolymers and homopolymers are emphasized. It is shown how these differences affect properties, processing conditions, and use applications.

•

Heat-Resistant Encapsulating Resins. M. M. Lee, Polymer Specialist, and R. D. Hodges, Mgr. of Chemical Research & Development, Fort Wayne Laboratory, General Electric Co., Fort Wayne, Ind.

The heat-resistance values for several types of encapsulating resin systems are of major importance because of the effect of high temperatures on many significant properties. The heat-resistance of such a resin system should be evaluated not only on the basis of one property, but on the results obtained in a combination of thermal tests. A complete evaluation of the resin can only be determined by applying it in the specific end-product.

•

Advances in the Technology of Plastics: Developments in Vinyl and Related Materials During 1959. William Cummings, Kralastic Research Group Leader, Naugatuck Chemical Division, U. S. Rubber Co., Naugatuck, Conn.

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tops
to cap the purity of glass...
O-I
OWENS-ILLINOIS
calls on performance-proved
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phenolic molding compounds
A BOTTLE without a cap is like a house without a door. For the molding of lightweight, high strength, threaded closures, phenolics have long established their superiority. And Owens-Illinois, one of the country's foremost manufacturers of glass containers and other glass products, produces such closures by the zillion!
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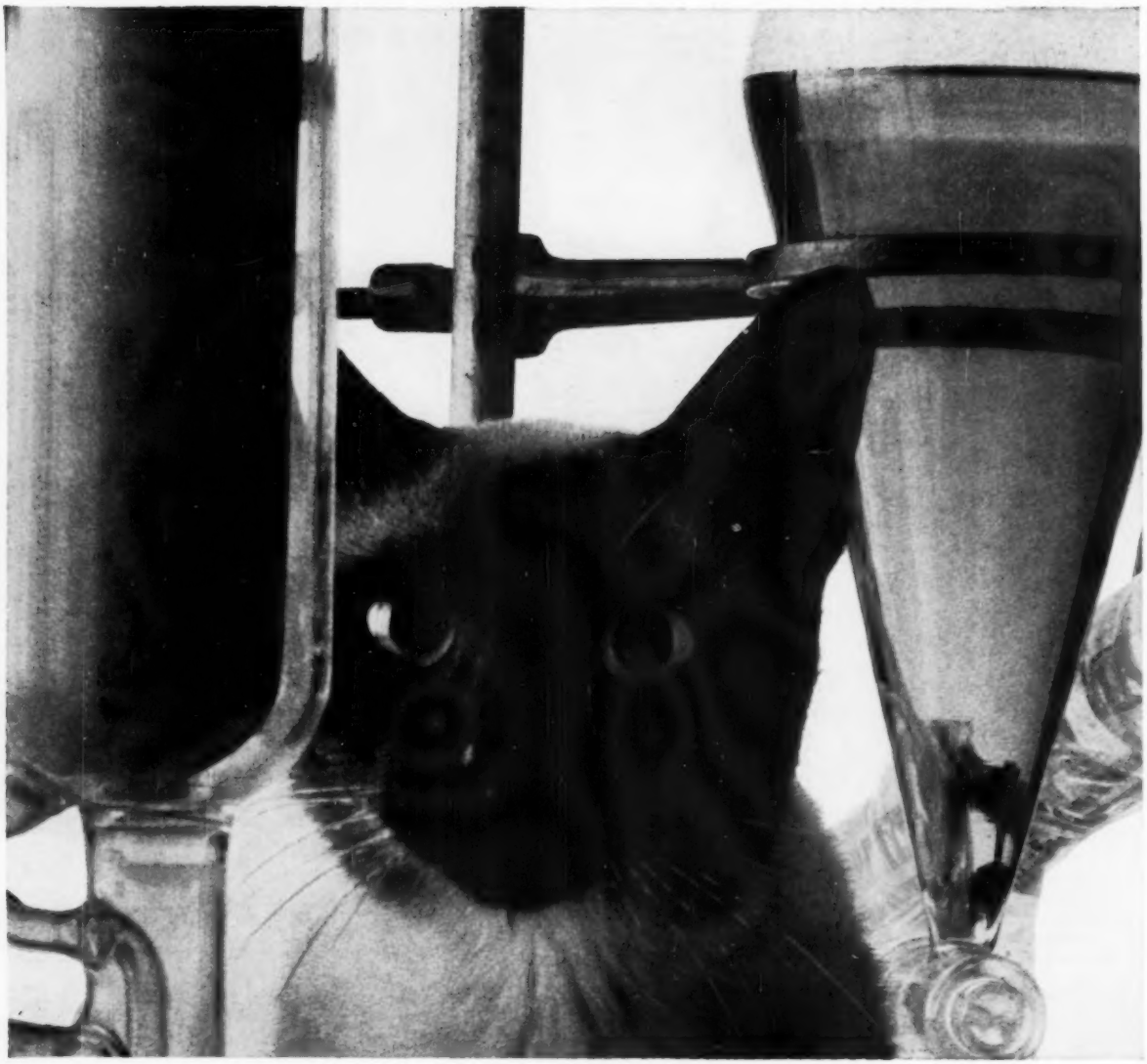

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No need to take chances. *Argus has the answers* that will spare you costly mistakes.

Day after day, Argus researches, tests, evaluates countless vinyl compounds to bring you stabilizers and plasticizers that make your products perform as you want them to.

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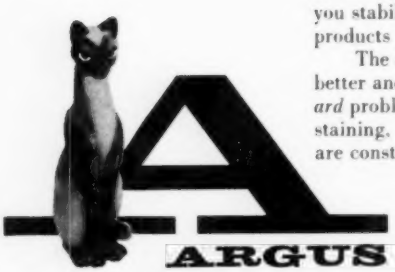

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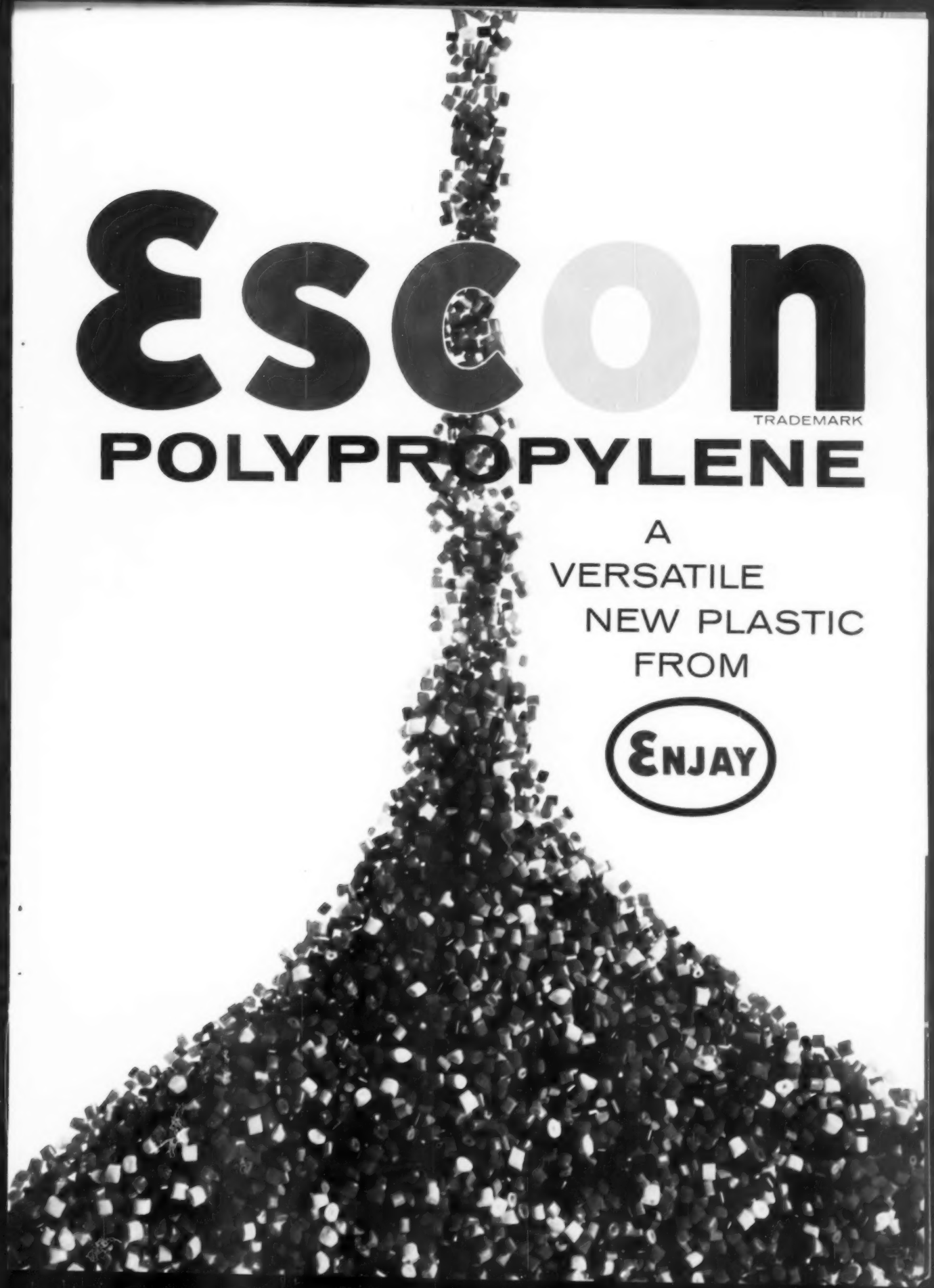
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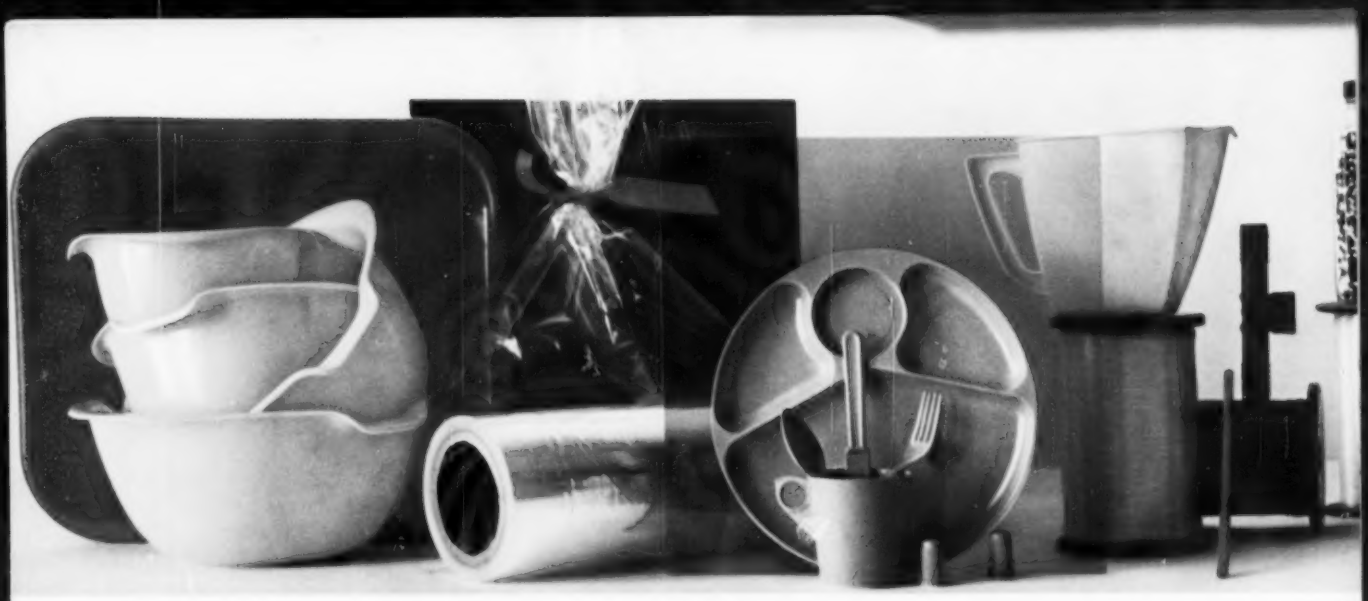


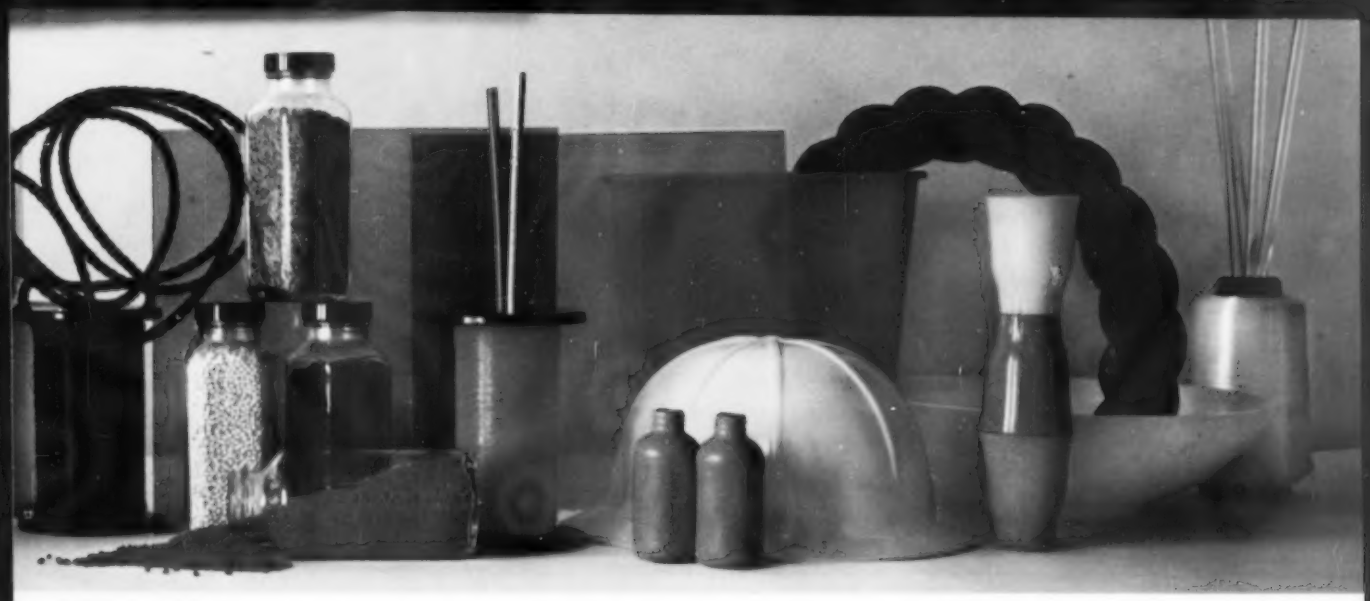
Specify ENJAY Escon

TRADEMARK

This new thermoplastic resin is the world's lightest plastic. Yet it provides excellent strength and rigidity. It can be made in brilliant lasting colors with high surface gloss and hardness. Escon also offers outstanding resistance to chemicals and stress cracking. Versatile Escon can be fabricated in a wide variety of ways. For example, it can be injection

FOR PACKAGING. Escon film can be produced by water bath or chill roll technique with extreme clarity and gloss. It offers greater heat resistance than any other polyolefin and can be sterilized by heat or chemical means. In addition, Escon offers excellent stiffness and toughness. Escon clear film can be color printed on either side — or both sides — for extra eye and buy appeal.

FOR MOLDING. Because of its light weight, Escon yields more pieces per pound. In injection molding, Escon's high strength plus its unique chemical and abrasion resistance makes it suitable for the manufacturing of many consumer products. Escon also allows accurate reproduction of fine and intricate designs with high surface lustre.

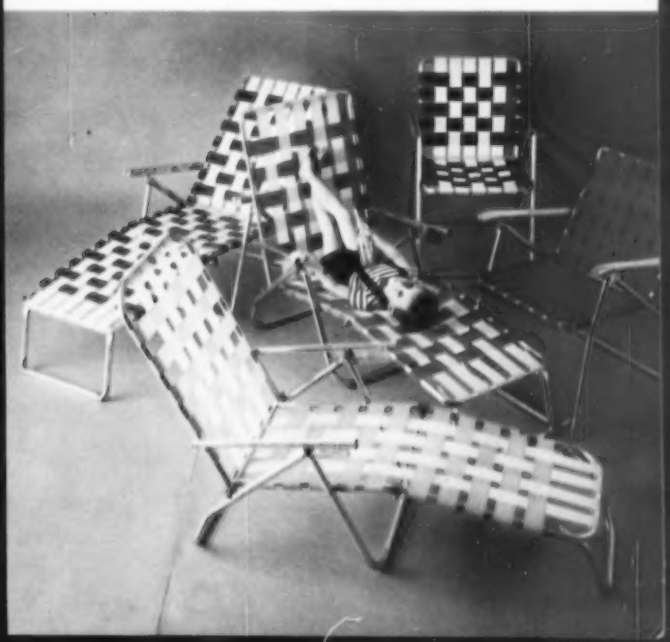


polypropylene for new beauty, utility and economy

molded; extruded into film, sheet and shapes. It can also be drawn and vacuum formed, heat sealed, machined and printed. Because of the rigid manufacturing standards of the Enjay Company, molders and designers are assured of high uniform quality whenever they specify Escon polypropylene. Versatile Escon can be tailor-made to meet a variety of product needs.

FOR EXTRUDING. Escon may be extruded in an almost unlimited range of thicknesses and forms. Its excellent physical and chemical properties make it an ideal plastic for such operations as thermoforming, punching, machining, die cutting and welding. Surface details are accurately reproduced too. And pigmentation, before or during extrusion, produces brightly colored sheet stock.

FOR FIBERS AND MONOFILAMENTS. Escon allows more yards of fiber per pound. Its high tensile strength, good knot strength and resilience, plus its immunity to attack by fungus, moths and marine organisms make it ideal for ropes and woven fabrics. Escon fibers show excellent wet strength, wet flexing durability, and abrasion resistance maintained to minus 70°F.



Escon

TRADEMARK

OFFERS A UNIQUE COMBINATION OF OUTSTANDING PROPERTIES

Various grades of Escon are offered to permit the processor to choose the grade best suited to his needs. Values for properties tabled at right will vary depending upon how the sample is formed and treated. Ask us for help on your specific requirements.

How Enjay helps you profit with Escon — Escon can help your product do a better job. To assure this, Enjay offers you complete technical assistance from one of the world's best staffed and equipped technical service laboratories. Here Enjay scientists can help you develop new products and improve existing ones through efficient use of Escon polypropylene.

To order Escon or for complete technical data, contact the Enjay office nearest you.

PROPERTY	DATA	METHOD
density, 73°F., g./cc.	0.897-0.910	ASTM D1505-57T
melt index, @250°C., g./10 min.	1-10	ASTM 1238-57T (load, 2,160g.)
environmental stress cracking (100% Igepal CD-630)	none	Bell Labs.
burning rate	slow	ASTM D635
machining qualities	excellent	
mold shrinkage, in./in.	0.015-0.030	
water absorption, %	< 0.01	ASTM D570-57T
yield strength, psi, 2"/min.	3800-5100	ASTM D638-58T
tensile strength, psi, 2"/min.	3500-4900	ASTM D638-58T
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ultimate elongation, %, 2"/min.	22-315	ASTM D638-58T
Impact strength, ft.-lb./in.		ASTM D256-54T
Izod notched	1	
Izod unnotched	> 16	
hardness		
Rockwell R	80-90	ASTM D785-51
Shore D	70-75	ASTM D676-55
elastic modulus, psi, 2"/min.	45,000-60,000	ASTM D638-58T
flexural modulus of elasticity, psi, 2"/min.	111,000-176,000	ASTM D790-58T
flexural modulus of rupture (flexural strength), psi, 0.05"/min. (no break-max. load)	65,000-81,000	ASTM D790-58T
compressive yield stress, psi, 0.05"/min.	5,300-6,400	ASTM D695-54
compressive strain @yield, %, 0.05"/min.	15	ASTM D695-54
compressive elastic modulus, psi, 0.05"/min.	53,000-63,000	ASTM D695-54
stiffness in flexure, psi	95,000-150,000	ASTM D747-58T
modulus of elasticity, psi	100,000-128,000	ASTM D1043-51
Taber abrasion, mg. loss/1000 cycles (CS-17 wheel, 1000g. load)	29-32	
melting point, °F.	335	polarizing microscope
vicat softening point (1 kg.), °F.	266-293	ASTM 1525-58T
deflection temperature		ASTM D648-56
°F. @264 psi fiber stress	131	
°F. @66 psi fiber stress	188	
coefficient of thermal conductivity		
cal./cm./cm.²/sec./°C.	2.80×10^{-4}	
BTU/in./ft.²/hr./°F.	1.13	
coefficient of linear thermal expansion in./in./°C.	0.00020	ASTM 696-44
specific heat @73°F., cal./g.	0.46	
ELECTRICAL PROPERTIES		
volume resistivity, ohm-cm	6.5×10^{16}	ASTM D257-54T
dielectric strength, volts/mil		
short-time, 1/8" thickness	660	ASTM D149-55T
step-by-step, 1/8" thickness	650	
dielectric constant, 10^6 cycles	2.0	ASTM D150-54T
dissipation (power) factor, 10^6 cycles	0.0002-0.0003	ASTM D150-54T

ENJAY PLASTICS

EXCITING NEW PRODUCTS THROUGH PETRO-CHEMISTRY

ENJAY COMPANY, INC.,

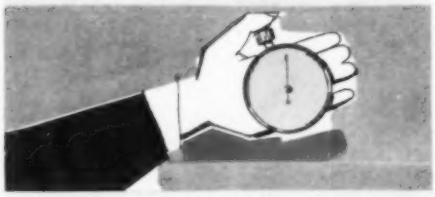
15 West 51st Street, New York 19, N. Y. • Akron
Boston • Charlotte • Chicago • Detroit • Los Angeles
New Orleans • Tulsa • Toronto

Memo to Molders NO. 4 OF A SERIES

QO® FURFURAL FOR PHENOLICS IMPROVES PRODUCT QUALITY AND MOLDING EFFICIENCY

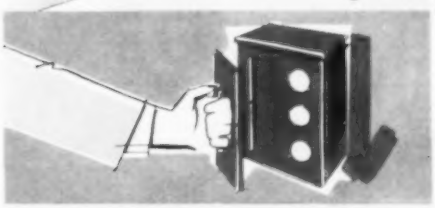
Your resin supplier uses QO furfural to give you one or more of the following benefits:

EXCELLENT LONG-FLOW CHARACTERISTICS
to simplify molding of large and intricate pieces.

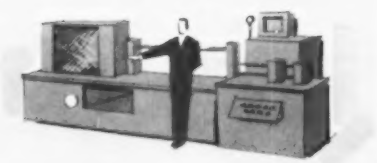


FAST MOLDING CYCLE
for lower production costs.

GOOD FINISH
for maximum customer appeal.



IMPROVED ELECTRICAL PROPERTIES
for special applications.

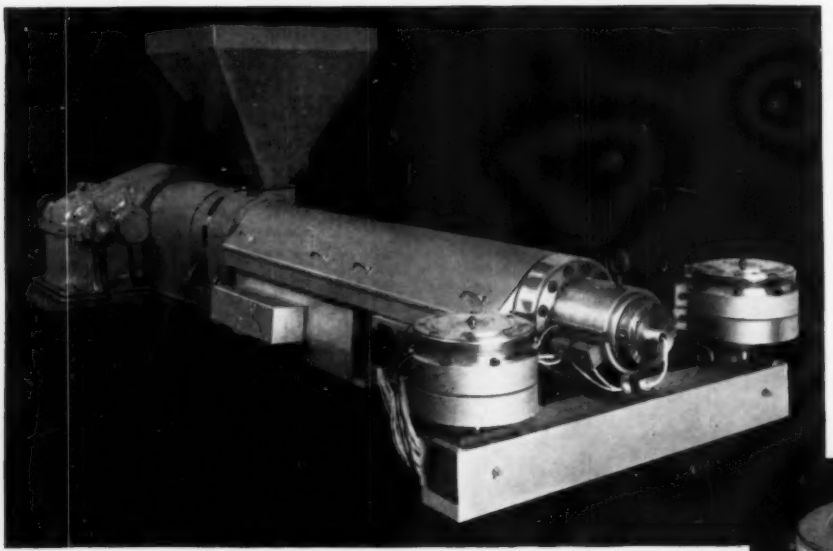


QUICK AND CLEAN EJECTS FROM THE MOLD
which cuts down-time and rejects.

Chances are, these are qualities you've been seeking. So check with your resin supplier to see how you can benefit by using a furfural-phenolic resin. The Quaker Oats Company does not manufacture molding compounds, but will gladly put you in touch with suppliers.

The Quaker Oats Company
CHEMICALS DIVISION
334H The Merchandise Mart, **Chicago 54, Illinois**

BEST FOR LAYFLAT TUBING



EGAN EXTRUDERS

Available with low base for layflat tubing installations

Egan Extruders offer distinct advantages in any blown film installation! A low base permits extra cooling space, and easier access to dies and feed section. The manifold arrangement, illustrated on the above 4½" extruder, permits full output even when using small dies. The manifold is valved so that one side only can be used, if desired. Complete engineering data available upon request, covering the full line of Egan Heavy Duty Extruders.

EGAN DIES

No weld lines
More uniform gauge
Better quality film

The Standard 24" Egan Die shown above has a center feed arrangement, incorporating a specially designed mandrel. It eliminates "weld lines," and assures uniform pressure at the die orifice. The result is a more uniform gauge and better quality film!

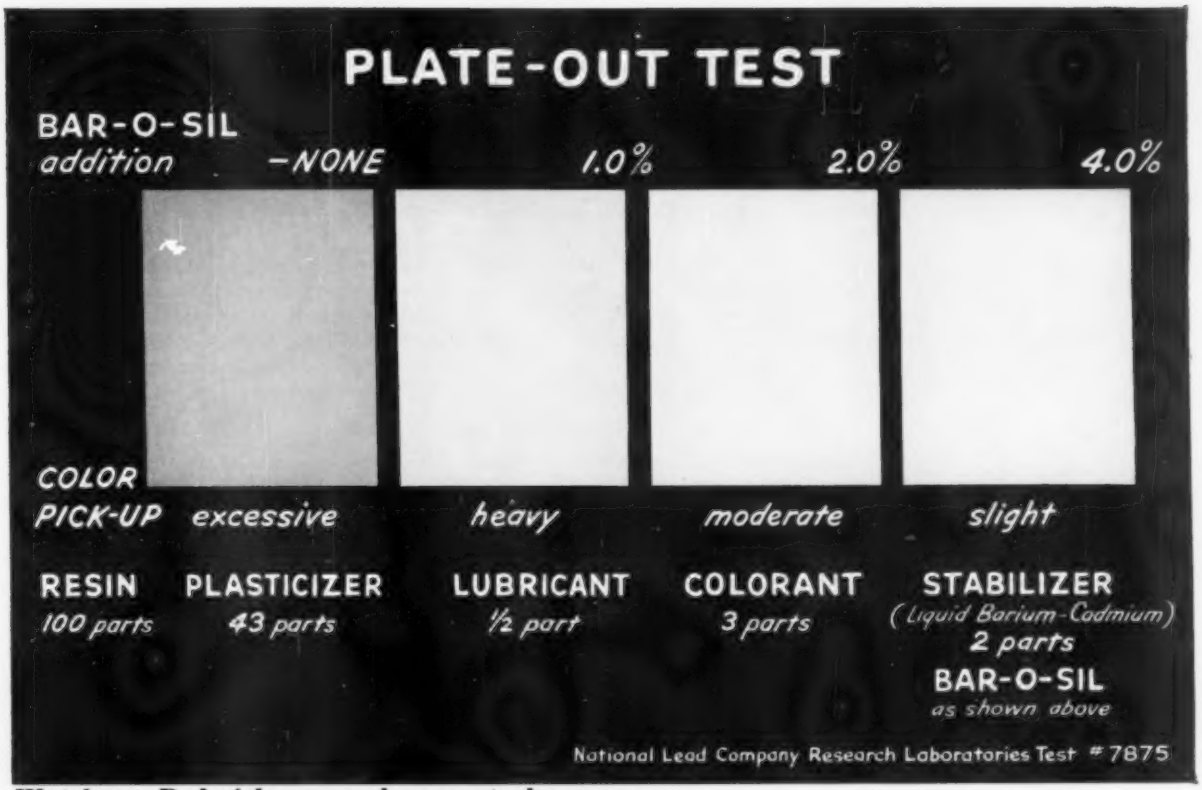
Egan Dies are available in a wide range of sizes.

Egan

FRANK W. EGAN & COMPANY
SOMERVILLE, NEW JERSEY Cable Address: EGANCO - SOMERVILLE NJER

Manufacturers of plastics extruders, dies, take-offs, and other accessories

REPRESENTATIVES: MEXICO, D. F.-M. H. GOTTFRIED, AVENIDA 16 DE SEPTIEMBRE; JAPAN-CHUGAI BOYEKI CO., TOKYO. LICENSEE: GREAT BRITAIN-BONE BROS. LTD., WEMBLEY, MIDDLESEX.



Watchung Red pick-up on cleanup stock proves...

novel new supplementary stabilizer gives best-yet control of plate-out

No need to change barium-cadmium stabilization base!

There is a standard vinyl industry test of plate-out. Recently, at National Lead Laboratories, we used it to evaluate a new and novel approach to the control of plate-out . . . with gratifying results.

Test procedure was simple. BAR-O-SIL*, a newly developed National Lead barium-silicate supplementary stabilizer, was added in varying quantities to a number of different barium-cadmium-stabilized stocks heavily overloaded with Watchung Red. Immediately after calendering each sample, a cleanup compound was run. Degree of color pick-up indicates degree of plate-out control established by given levels of BAR-O-SIL stabilizer content. In our many tests, the reduction of color pick-up has always been proportional, depending on extent of plating initially present.

Stop one production run, start the next...in minutes without cleanup

As you can see, BAR-O-SIL stabilizer provides an interesting new tool for plate-out control in barium-cadmium-stabilized stocks. Now it's practical to run color after color in quick succession.

Best of all, this unique supplementary stabilizer provides plate-out control without affecting proven (or new) stabilizations, without altering sensitive colorants, and without increasing yellowing or susceptibility to staining.

BAR-O-SIL stabilizer has several additional desirable effects . . . adds heat stability; sharply reduces hazing, crocking, spewing; controls migration of plasticizer. In calendered products, it imparts a very pleasing dry hand.

Brochure for the asking

Would you like the technical details? Use the coupon below to send for the BAR-O-SIL brochure. *Trademark

KL-6290

NLC

The National Lead Company: *General Offices;* 111 Broadway, New York 6, N. Y.
In Canada: Canadian Titanium Pigments Limited, 1401 McGill College Avenue, Montreal

Gentlemen: Please mail me your BAR-O-SIL stabilizer brochure.

Name_____ Title_____

Firm_____

City_____ State_____

BAR-O-SIL*
(Stabilizer)

A Chemical Development of **National Lead Company**

General Offices: 111 Broadway, New York 6, N. Y.

What's New in Processing

Engel Process—a Dutch process for fabricating large thermoplastic articles cheaply—has been licensed to Spencer Chemical Co., who will, in turn, license the method to a limited number of American fabricators. Spencer will furnish a special powdered polyethylene which is fused in an oven. The material then can be formed into hollow articles of almost unlimited size in relatively inexpensive molds. Suitable applications to date have included 15-gallon multiple-trip carboys, drum liners, tote boxes, pleasure boats, and bathtubs.

Eastman Chemical Products, Inc., exhibited a new, speedy process for forming and decorating outdoor signs at the National Electric Sign Association show in Los Angeles earlier this month. Butyrate sheet is continuously extruded in two different colored layers. vacuum formed to the desired contour, and decorated by sanding off the upper layer where it covers a raised design or lettering. This eliminates the "wait" between application of background and decorative colors. Since both layers are the same material, there is no chipping or flaking.

Patents

Becco Chemical Division, Food Machinery & Chemical Corp. has been granted U. S. Patent No. 2,919,283 covering a process for in situ epoxidation using ion-exchange resins as the catalyst and hydrogen peroxide as the oxidant. The process eliminates the need for using pre-formed peracids, and permits the use of cheap agricultural derivatives such as soybean oil, oleic acid, and tall oil fatty esters. The resulting plasticizers have a "built-in" stabilizing effect against heat and light.

E. I. du Pont de Nemours & Co., Inc., has obtained U.S. Patent No. 2,884,663 on a means for improving linear terephthalate ester film by stretching in one direction at 20-205° C., and heat setting it at 150-235° C., under tension sufficient to prevent shrinkage in that direction.

Plastic Piano Action is the title of U. S. Patent No. 2,881,509 which has been granted to Richard Gadebusch of Arvika, Sweden. It covers a method for making a pivot bearing having a thermoplastic part with rotatably-mounted pivot pin.

Crown Cork & Seal Co. was awarded U. S. Patent No. 2,881,480 for a method of forming a polyethylene liner for a crown closure shell. A polyethylene cube is molded into an over-all symmetrical liner.

Abstracts

"Dry Coloring Polypropylene" was discussed by Robert A. Charvat in the November issue of Modern Plastics, with emphasis on newly-designed spherical venturi. Also in this issue is an article by R. L. Ballman and T. Shusman on an "Easy Way to Calculate Injection Molding Set-Up Time" and an article by G. S. Mackrin on "How To Saw Plastics."

"The Vacuum Forming of High Density Polyethylene" by D. Burgess appeared in the May issue of British Plastics. The author outlines equipment modifications and techniques for overcoming certain difficulties.

"The Production of Vacuum Formings of Uniform Wall Thickness" by D. J. A. Lee and F. A. Welham appeared in the June issue of British Plastics. Plug-assist vacuum forming is described in three different forming problems—a disposable beaker, a tray, and a series of closely-packed cubes. Tooling is also covered.

"Milling Cellulose Acetate Sheet" by Peignon and Delord appeared in the June isue of Industrie Plastiques Modernes. It reports on the machining of the sheet with formed milling cutters using different setting angles, lateral tapers, rates of advance, and lubrications. Optimum conditions are suggested.

U.S.I. POLYETHYLENE NEWS

A series for plastics and packaging executives by the makers of PETROTHENE® polyethylene resins

MARCH, 1959 — U. S. Industrial Chemicals Co., Division of National Distillers and Chemical Corporation — 99 Park Ave., N. Y. 16, N. Y.

Packaging Notes

A polyethylene-paper pouch for cake mixes permits savings in packaging materials and labor for a Canadian producer. The savings enabled the firm to lower the retail price of its product from 29 to 19 cents a package. The product was previously packaged in plain paper pouches stuffed in cartons.

The new 15 oz. package consists of a paper container with four-color printing on the outside and a 1.75 mil polyethylene lining on the inside. The package is produced by feeding separate rolls of paper and polyethylene film into a converting machine. The two-layered pouch is filled as it is formed.

Polyethylene film insert forms inner compartment of a disposable wirebound wooden liquid container. The new lightweight 15-gal. container consists of a polyethylene liner within a corrugated cardboard cushion. The outer surface is a wire-bound wooden box which provides rigidity and strength.

Easy emptying is provided by a flexible, pull-out pouring spout. The manufacturer claims many advantages over glass-type carboys, which cost an average of $2.50 to $6.00 per trip.

Initial cost of the new "carboy" is 20% lower than glass-type carboys, and it eliminates return freight costs, cleaning repairs, double bookkeeping and inventory. The new containers occupy half the space and are 51 lbs. lighter than glass carboys.

The containers are said to meet industry standards for safe handling and shipping.

A polyethylene package is now replacing tin cans for packaging sterilized milk produced by a west coast dairy. Combined cost of container, filling, and shipping of the tetrahedral-shaped packages is said to be half that of standard metal cans... the only previous method for storing sterilized milk indefinitely without refrigeration. The new package creates a gas barrier comparable to that of a metal can. It has possibilities for many products which normally require refrigeration for preservation.

The package walls consist of a four-ply lamination of paper, a polyethylene extrusion, metal foil, and polyethylene film inside. The foil, surrounded by polyethylene, is used in the pyramid-shaped packages in such a way as to provide an absolute barrier.

Aseptic methods, including a chlorine wash, are used before packaging to eliminate all contaminants from product and package. The package is filled slightly above the "full" line.

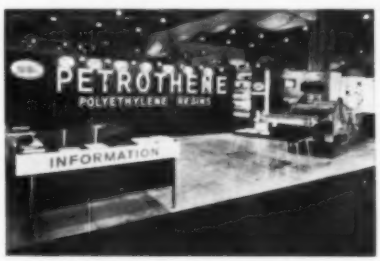
When the heat sealing jaws close, a filled, hermetically sealed container results, with no residual air pocket.

Be sure to visit the
U.S.I. EXHIBIT — BOOTH 1231
29th NATIONAL
PACKAGING EXPOSITION
CONVENTION HALL, APRIL 4-7
ATLANTIC CITY, NEW JERSEY

U.S.I. Technical Specialists to Answer Questions on Polyethylene at Exposition

Cast Polyethylene Film to be Shown at Atlantic City Show

Record attendance is expected at the American Management Association's 29th Annual National Packaging Exposition, April 4-7, at Atlantic City's Convention Hall. U.S.I. will occupy space on the lower level at Booth 1231, where visitors will again be invited to take advantage of U.S.I.'s Technical Information Center on polyethylene film. In a departure from normal industry practice of manning such exhibits primarily with sales personnel, it has been U.S.I.'s custom to offer the services of trained technical specialists who are well versed in polyethylene technology as it applies to packaging applications of a wide variety.



Last year's packaging show featured the Technical Information Center, above. U.S.I. representatives will be available again this year to answer questions on polyethylene packaging.

This year, members of U.S.I.'s Polymer Service Laboratory will be on hand to advise converters and packagers on such problems as the proper selection of polyethylene film most satisfactory for a given application, and heat sealing methods and equipment. Other questions of interest to packagers of baked goods, drug products, meat and poultry, produce and soft goods will also be answered.

Applications of Cast Film to be Shown

This year's Atlantic City Exposition will be the second anniversary of U.S.I.'s introduction of cast polyethylene film. Cast film and its latest applications will again be a part of U.S.I.'s exhibit. Packagers are encouraged to make use of this opportunity to discuss innovations in polyethylene packaging that have developed in the past year.

New Resin to be Introduced

A new resin, tailored to those packaging applications that demand a combination of high toughness with high clarity and gloss, will be demonstrated.

New Automatic Machine for Packaging With Polyethylene

A new polyethylene bagging machine designed for fine-line edge sealing was recently introduced for packaging both rigid and non-rigid products. The machine automatically forms the bag from flat film around the object to be packaged.

Because packages are sealed on three sides, there are no seams to mar either side of the bags. The entire surface of each side of the package is available for printing, and placement of seals also offers complete product visibility.

A special intake conveyor will accommodate from 1 to 5 bag loading stations, and feeds filled packages into an automatic heat sealer which makes seals immediately adjacent to the product. The new machine is said to handle from 10 to 100 packages per minute.

U.S.I. Announces Booklet On Polyethylene Printing

"Printing of Polyethylene" is the title of a new U.S.I. booklet just off the press. It's the latest addition to special U.S.I. literature designed to help achieve finest results with polyethylene packaging film.

The new booklet discusses methods of film treatment, printing techniques, printing inks, and field test procedures. It also contains a glossary of commonly-used ink and printing terms.

A copy of this valuable 16-page booklet is available upon request. Just write to Editor, U.S.I. Polyethylene News, U. S. Industrial Chemicals Co., 99 Park Ave., New York 16, New York.

Polyethylene Valuable for Rice Field Levees

A Texas agricultural station is experimenting with polyethylene sheeting for use in rice field levees.

The film or sheeting used is black polyethylene, 3 ft. wide. Various thicknesses are being tried in the experiments. It is anchored in place by dirt, back-plowed along its lower edge. Further support comes from 1" x 4" stakes placed 5-10 ft. apart. The levee withstands substantial winds and a 5-in. head of water.

The researchers report many advantages of the polyethylene levees. They eliminate dirt levees which take 4-10% of available acreage and are prone to germinate undesirable grasses and weeds. The levees also make possible the harvesting of rice fields in single units, rather than by following the contours of dirt levees.

U.S.I.
Vol. V, No. 2

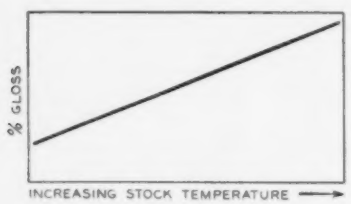
POLYETHYLENE PROCESSING TIPS

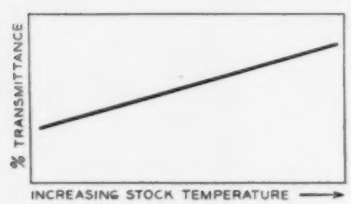
HOW STOCK TEMPERATURE AFFECTS THE OPTICAL PROPERTIES OF CAST FILM

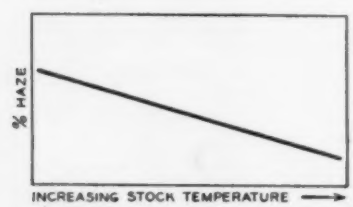
Stock temperature is a key factor among operating variables affecting the optical properties of cast polyethylene film. Fortunately, the extruder can control stock temperature with a high degree of accuracy to produce film of optimum gloss and transparency and minimum haze.

Gloss is generally defined as the percent light reflected at an angle from the surface of the film, as determined by standard measuring techniques. Transparency, or transmittance, is the percent light which will pass through the film. Haze is the percent light scattered as it passes through the film.

The graphs below show the general effect on these vital optical properties with changes in stock temperature.



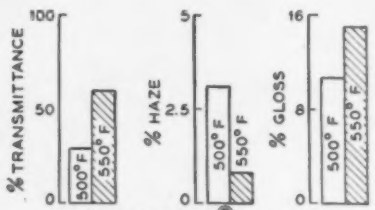




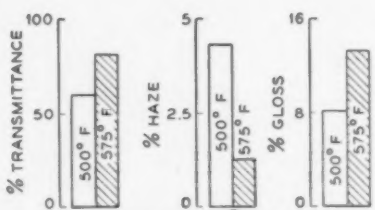
Effect Varies With Resin

Within limits, the amount of change in the film's optical characteristics brought about by raising or lowering the temperature varies with the resin being processed. In some cases, for example, improvements of 50% or more in gloss and transmittance result from increased temperature. Similarly, a 75% reduction in haze is sometimes possible. These results are much greater than would be expected from the above graphs of the general effect.

The following bar graphs show examples where temperature increases of 50°F and 75°F greatly improved the clarity of films of two different resins.



"PETROTHENE"® RESIN A:
MELT INDEX 2.0, DENSITY 0.928



"PETROTHENE"® RESIN B:
MELT INDEX 8.0, DENSITY 0.915

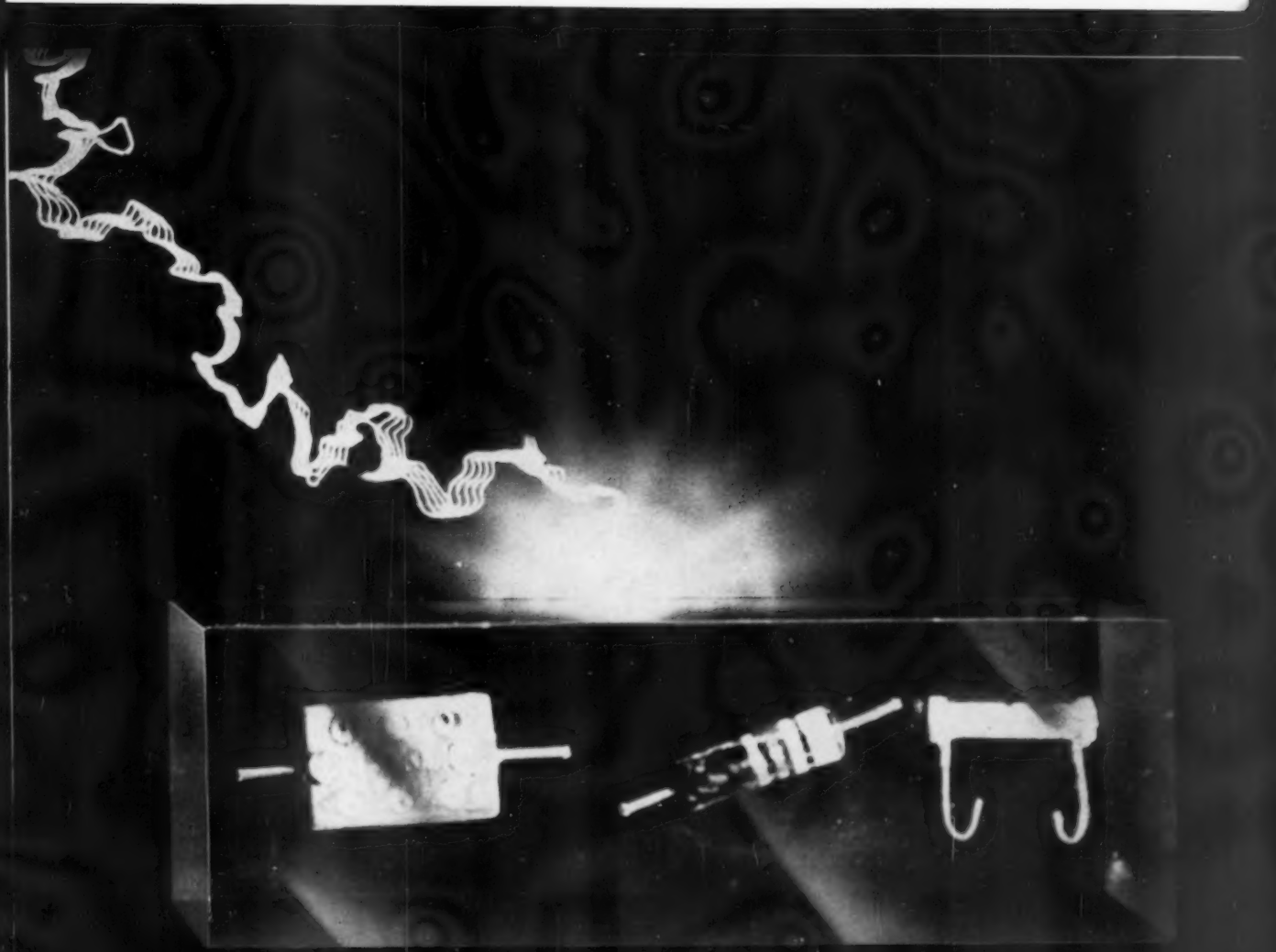
These differences in films produced at different temperatures also underscore the need to keep resin temperature uniform. (See U.S.I. Polyethylene Processing Tips, Vol. V, No. 1 for a detailed discussion of the importance of stock temperature control.)

Balanced Extrusion Conditions Necessary

In the production of cast film, the requirements of the end use are most often the major consideration. To achieve the desired film properties with the equipment available, the extruder must concern himself not only with stock temperature, but with the establishment of a balance of extrusion conditions and resin properties.

U.S.I. technical service engineers will be glad to work with you in determining the best stock temperature for your operation. Ask for their assistance on this or other processing problems.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.
Branches in principal cities



A resin that gets no charge out of high voltage

GLIDPOL polyester resins present a clear case of positive insulation for delicate electrical components—terminal blocks, coils, transistors.

No matter what the process, whether encapsulating, embedding, potting or casting, GLIDPOL resins are formulated to provide not only the right protective barrier against high voltage but humidity, impact, vibration, corrosion and chemicals as well. And they can easily be pigmented in a wide range of colors.

Write for complete information on the GLIDPOL polyester resin system best designed to meet your particular protective requirements.

QUALITY Glidden PRODUCTS

RESINS FOR EVERY APPLICATION

The Glidden Company
INDUSTRIAL PAINT DIVISION
900 Union Commerce Building • Cleveland 14, Ohio
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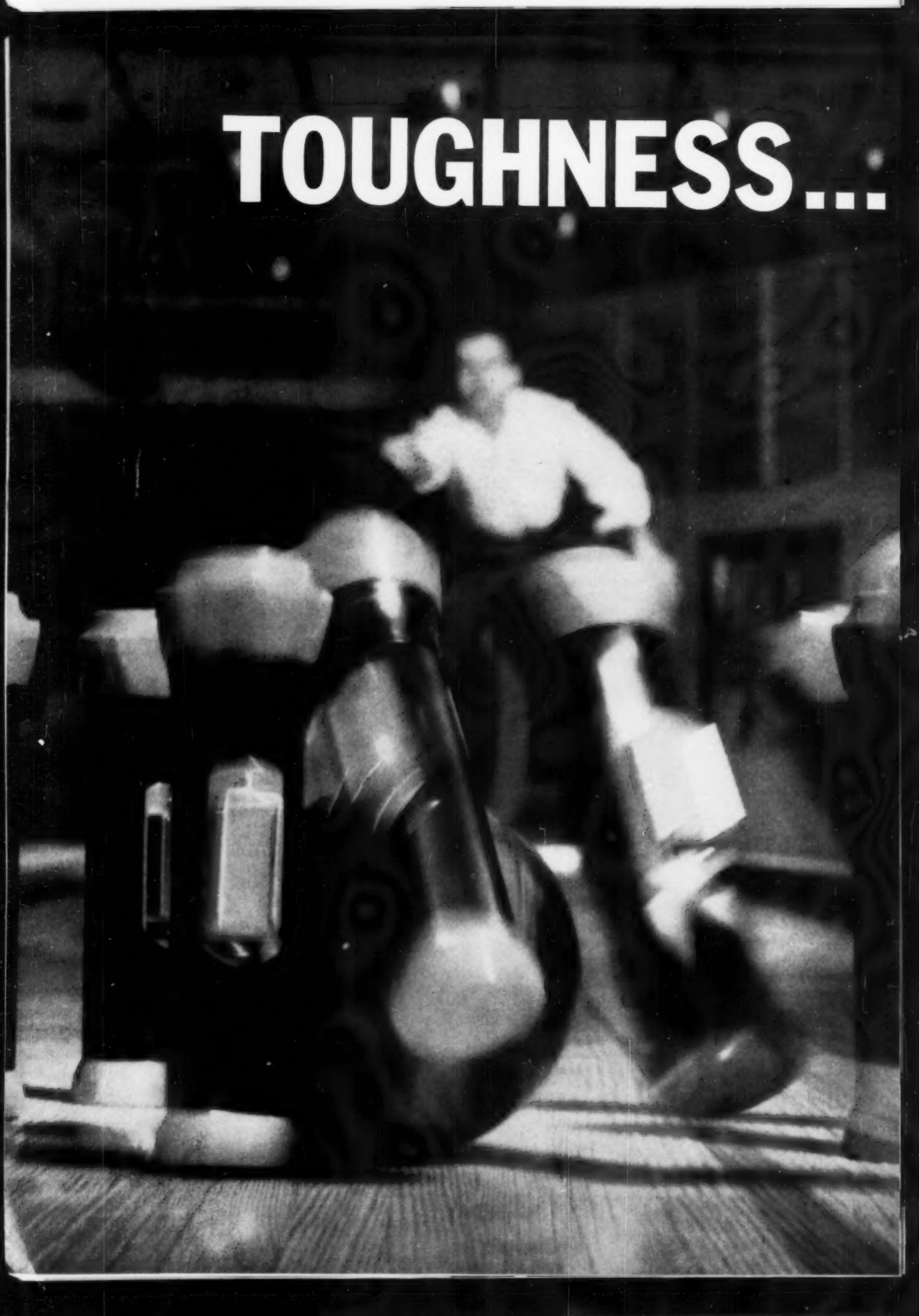
There's a GLIDPOL Polyester Resin system, plus Glidden Technical Service, to help you do it better, more economically, whatever your product, process or problem.

TOUGHNESS...



...another way high-density polyethylene IMPROVES YOUR PRODUCT

FLASHLIGHTS HAVE TO BE TOUGH, and these EVEREADY "Cordahide" flashlights have to be tougher than most because they're specially designed for heavy-duty shop use. That's why their cases, lens rings and end caps are molded from BAKELITE Brand high-density polyethylene DGD-6201. Laboratory tests have proved this material's exceptional resistance to impact and abrasion, and its performance in actual use confirms every laboratory finding.

In addition to toughness, BAKELITE Brand high-density polyethylenes supply the exact combination of strength, rigidity, surface appearance, stress cracking resistance, dimensional stability, and moldability you need.

In fact, if you need *any* type of polyethylene, you can choose from a full range of BAKELITE Brand materials . . . extending through low, medium, and high densities. The list also includes the remarkable new polyethylene copolymers—notable for low-temperature toughness, stress cracking resistance, and long flex life.

In choosing and using these materials for your product improvements, you can call on the broad Union Carbide knowledge and experience in the field of plastics development. Mail the coupon today, or write a description of your requirements directly to Dept. CQ-61G, Union Carbide Plastics Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N.Y. *In Canada*, Union Carbide Canada Limited, Toronto 7.

TYPICAL PROPERTIES OF DMD-6201

	ASTM Test	
Density, gm./cc	D 792-50(A)	.950
Melt Index, gm./10 min.	D 1238-57T	8.0
No-Load Heat Distortion Temperature		128°C (262°F)
Secant Modulus (Stiffness), psi	D 638-58T	100,000
Tensile Strength, psi	D 638-58T	3300
Ultimate Elongation, %	D 638-58T	45
Tensile Impact (ft. lbs./cu. in.)		50

All physical tests conducted on samples with no orientation.

BAKELITE, UNION CARBIDE, EVEREADY and CORDAHIDE are registered trade-marks of Union Carbide Corporation.

UNION CARBIDE

EVEREADY "Cordahide" shop lites have the toughness to take the impact of a bowling ball, the hardwood alley, and one another—and still come up intact.

Dept. CQ-61G
Union Carbide Plastics Company
Division of Union Carbide Corporation
30 East 42nd Street, New York 17, N. Y.

Please send me information on BAKELITE Brand high-density polyethylenes with particular emphasis on these properties . . . . . .
the application being considered is . . . . . .

Name _____

Firm name _____

Street _____

City _____ State _____

This Month In Brief

The market for plastics in building is the topic of this month's Editorial. Despite all the encouraging signs that were (and still are) evident for plastics usage in building applications, progress to date has been slow and painful. The factors contributing to this slowness include building codes, labor union regulations, ignorance of architects and building engineers, and the black-eye given plastics in the eyes of customers.

The Guest Editorial in this issue, written by William Gobeille, Manager of Plastics Operation for American Motors Corp., gives a very interesting and optimistic forecast on the outlook for plastics in automotive applications and tooling. The company's plastic laboratory made a study of automotive applications where plastics would give functional improvements, cost savings, or both, and arrived at a conservative total-weight per car of 60-100 pounds. This interest in plastics was triggered by the newer materials with high physical properties.

Some notes on the Technical Articles this month are as follows:

The lead article, "Oxidation in Extrusion," discusses the factors (inadequately designed equipment and improper processing conditions) that lead to excessive oxidation in polyethylene extrusion.

"Fabricated (Built-Up) Molds" describes a mold construction method for use with low-bulk, low-pressure glass/polyester molding materials that offers cost savings and increased moldmaking efficiency.

"Clay Fillers in Structural Reinforced-Plastics Parts" shows how fillers of this type enable a manufacturer to meet high physical-property requirements on the parts he makes.

Diallyl phthalate and powdered polyethylene are the subjects of Lee Zukor's engineering section, Exploring Fabrication Techniques, this month. Diallyl phthalate resins have recently made their entry into the field of laminating, whereas previously they had been utilized only in compression and transfer molding. The methods for impregnating and curing the laminations are described. In discussing powdered polyethylenes, major attention is given to fluidized bed coating as the main method of application for these powders. This method of coating is described, with mention of its advantages and disadvantages.

Three Engineering Forum columns in this issue; Compression & Transfer Molding, Moldmaking & Tooling, and Reinforced Plastics, in alphabetical order. The first covers the inadequate property data, specifically tensile and impact strength values, given in the usual data sheet made available from the material supplier. The second Forum describes surface finishes for molds, and their need for standardization. The third column, with its catchy sub-title, suggests a testing program by which a reinforced-plastics processor can evaluate the different spray guns and select the one that best suits his individual requirements and manufacturing conditions.

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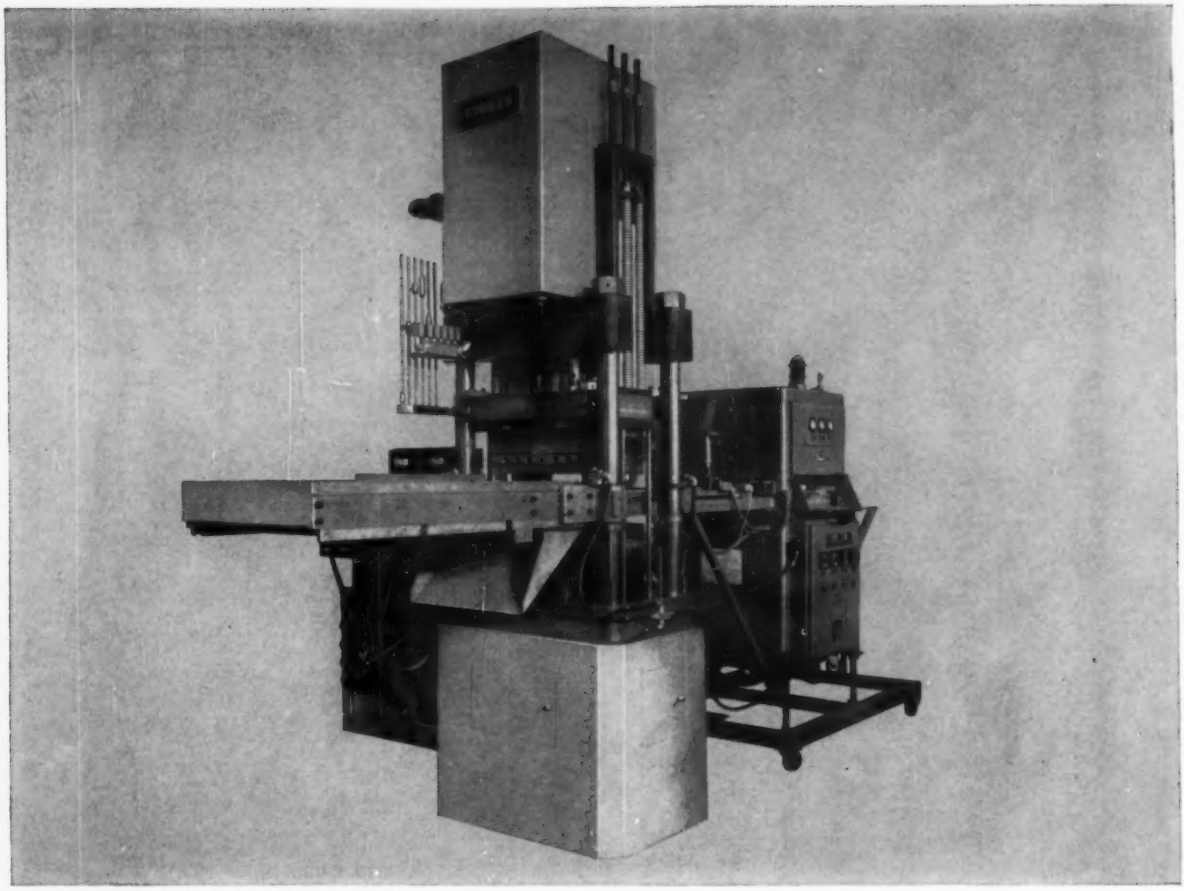

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STOKES

EDITORIAL:

The Market for Plastics in Building

More and more expressions and signs of impatience have been becoming evident on the part of the plastics industry over the slowness and painfulness of plastics' adoption and usage in the building field.

Years ago when plastics were fighting to achieve respectability, everyone in the plastics industry painted glowing pictures of the fascinating (and profitable) prospects awaiting plastics in the building field. By every standard, building offered a sure (nay, inevitable) large-volume field of application for plastics. Everyone in the plastics industry was intrigued by this potential, and rushed to join in the starry-eyed group of amateur sooth-sayers.

•

When developments in plastics materials, processing techniques, and fabricating methods removed the final roadblocks on the road before plastics could achieve recognition as true engineering materials worthy of use in building, everyone saw nothing in the future that could stand in their way.

But then some obstacles became evident that offered serious problems in the course of plastics for building. While these problems had been foreseen by some, no one thought that they would be insurmountable or even very troublesome. But "very troublesome" is just what they have proved to be, and are the reasons for plastics' impatience.

These troubles include outmoded building codes; systems and jurisdictional disputes in the building trades unions; ignorance on the part of architects, buildings, and buildings purchasers; and, it must be added, fear that plastics will not prove satisfactory in long-term building applications. Each item sounds only minor, but in actuality is quite major. The combination of items seems almost unconquerable, and quite unreasonable.

The first item, that of outmoded building codes—especially the many antiquated and contradictory code provisions, is quite obviously a serious hurdle. But overcome it will be, and even now is being overcome. This takes time!

Use of plastics requires education of the building trades to ensure that the materials are installed, used, and maintained properly. This, of course, requires education, and cannot be hurried. Not to mention allaying workers' fears that their jobs will be discarded by adoption of plastics instead of conventional materials. The problem of jurisdictional disputes by building trades unions is not quickly solved. Time, again!

The third problem, the ignorancy factor, is capable of being overcome with education. This, too, requires time (and effort) by the plastics industry.

The last problem cannot be truly solved before solving the first three.

•

Sober consideration of these "minor troubles" indicates that they are not minor at all. Concentrated effort is needed to overcome them, impatience doesn't help!

Arthur M. Merrill

Editor

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Ten Monsanto electrical-grade plasticizers can help you meet rigid standards for safe load-carrying capacity in wire and cable. They deliver highest properties consistently in electrical compounds and give you more "formulating flexibility" to compound for lowest cost—*highest profits.* Check the comparisons shown here, then write for more details, samples and compounding help from Monsanto's Plasticizer Council.

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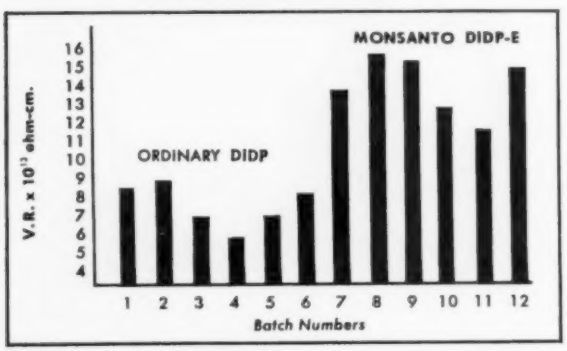

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Insulation resistance tests show that HB-40, blended with a primary plasticizer, can actually increase electrical properties while it cuts formulation costs.

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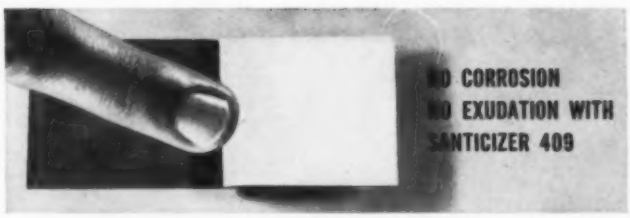
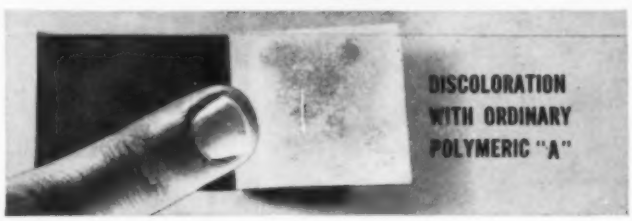
High humidity doesn't cause exudation of SANTICIZER 409 as it does with some other polymerics. (See photo.) Vinyl-covered copper electrodes were immersed in water for 12 weeks at 50° C. A reaction between the copper and the plasticizer in the vinyl shows as a greenish color on vinyl cover (above the copper conductor) which indicates exudation and poor compatibility. The photo at top shows no reaction for SANTICIZER 409 while the electrode with polymeric "A" shows considerable discoloration.





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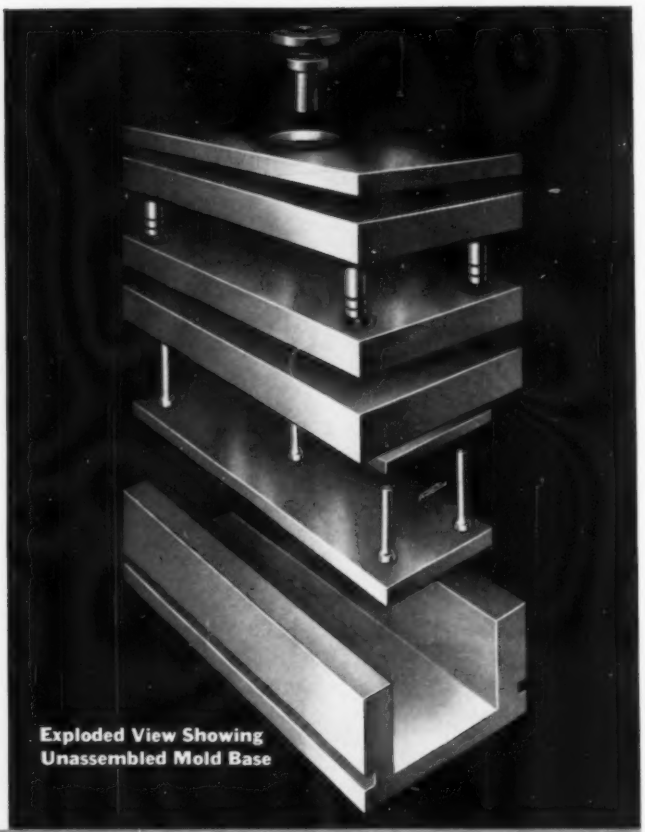

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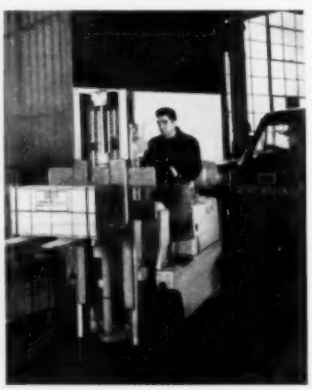

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PLASTICS
THE MAGAZINE OF APPLIED ENGINEERING
TECHNOLOGY

Oxidation In Extrusion

How proper extrusion equipment and operating conditions affect oxidation of polyethylene extrusions.

R. C. PHELPS, *Customer Service Group Leader*
and
R. F. KOWAL, *Customer Service Engr.*
Polymer Service Laboratories
U. S. Industrial Chemicals Co.
Tuscola, Ill.

THE oxidation of polyethylene during extrusion presents a serious problem, since both its processability and the physical properties of the end-product are affected adversely.

Oxidation is defined currently as the loss of electrons or, in organic chemistry, the loss of hydrogen. The replacement of two hydrogen atoms by an oxygen atom in a polyethylene chain can result in the formation of a carbonyl group. The removal of hydrogen atoms from adjacent chains will cause cross-linking. Infra-red spectrophotometry has shown that the main product of thermal oxidation in a limited supply of oxygen is carbonyl of the ketonic type accompanied by cross-linking. There is evidence that this reaction is auto-catalytic.

With an abundant supply of oxygen present, the oxidation passes the carbonyl stage and the polymer breaks down by chain scission. Chain scission also may occur in the absence of oxygen in the presence of excessive heat. Probably the former reaction, that of a limited supply of available oxygen, predominates in the extrusion process. However, unsaturation resulting from chain scission does occur, as is evidenced by dark-colored specks that occasionally appear in an extruded product. The amount of carbonyl present is directly related to the amount of oxidation that has taken place, as shown in Figure 1.

Equipment Problems

Factors leading to excessive oxidation in extrusion are numerous, and are due mainly to inadequately-designed equipment and improper operating conditions. A combination of properly-designed screw, streamlined polymer flow, judicious choice and location of temperature-controlling devices, properly rated heaters, and proper operating conditions will lead to a minimum amount of oxidation.

The screw itself, if properly designed, can minimize oxidation by reducing the amount of air entrained in the polymer feed. The factors in screw design which effect air entrapment are compression ratio, metering section channel depth, and pitch. Of these, compression ratio has the greatest effect, and should be kept at a minimum of 3.5:1.

More than 75% of the heat required to raise the polymer to the desired temperature will be obtained by the conversion of the mechanical energy supplied by the extruder drive if the screw is designed properly. This energy conversion will minimize the amount of heat required of the heaters, and thus reduce the hazard of localized over-heating at the cylinder-resin interface. A screw with a minimum clearance between the thread land and the cylinder wall will minimize the

thickness of the polymer layer remaining stationary, thus reducing the amount of material subjected to oxidation due to localized overheating.

Every attempt should be made to streamline the extrusion equipment and minimize polymer hold-up. Ideally, there should be no area where the molten polymer can stagnate. Trouble spots generally are the breaker plate, die adaptor, and the die itself. Any sharp corner is a source of polymer hold-up and subsequent oxidation. All areas requiring a change of polymer flow should be designed so that the change is gradual and leaves no "dead spots."

Another important phase in limiting oxidation in extrusion is extruder and die temperature-control. This involves the proper type and location of thermocouples, temperature indicator-controllers, and heaters, as well as routine standardization of these items. Thermocouples, generally of the iron-constantan type, have a relatively long life and stand a lot of abuse when properly constructed. Thermocouples should be placed as close to the resin-metal interface as possible in order to give a truer indication of the interface temperatures, although they will always differ from the true resin temperatures.

Temperature indicator-controllers should be of the proportioning type which have adjustable set-points, as well as sensitivity controls. There are several models of these instruments on the market which are widely used and easily serviced.

The heaters used on extrusion equipment should be chosen to give long life at the required wattage rating. The heater is one of the weaker spots in the extrusion process, in that considerable time may elapse before a defective heater is detected. If a defective heater is close to the thermocouple, a hot spot may occur near the heater in the same temperature control zone, and cause excessive temperature build-up with accompanying oxidation of the polymer. Wherever possible, this condition can be minimized by the use of an ammeter in the heater circuit of each temperature-control zone to indicate any variations in electrical load which might arise due to a defective heater.

The number of heaters controlled by each temperature control should be kept to a minimum to attain uniform temperature in the equipment. In general, long-barrelled 2½-, 3½- and 4½-inch extruders should have at least four zones of control, while extruders more than 4½-inches in size should have at least five zones—preferably more. The number of controllers, adaptors, and dies depends to a great extent on their configurations. Generally, the adaptor is on a zone by itself. Blown-film dies should have at least two zones, while flat-film dies should have at least one zone for every 10 inches of die length.

Extrudate Problems

A very important means of reducing oxidation during extrusion is the choice of proper operating conditions. Every major resin supplier can and will recommend proper extrusion conditions for his resins. Usually, a uniform temperature profile with no zone radically different from the others will minimize oxidation if all

Richard C. Phelps was born in Lisle, N. Y., on February 19, 1923. He received a B.S. in Chemical Engineering in 1951 from the Missouri School of Mines (Rolla, Mo.). Following his graduation, he joined Merck & Co. as Production Supervisor from 1951-1953; DuPont as a Research Engineer from 1953-1954; Spencer Chemical Co. as a Senior Chemist from 1954-1955; and Panelyte Division, St. Regis Paper Co. as a Development Engineer from 1955-1957. He went to U. S. Industrial Chemicals Co. in 1957, and has been with them to date as Customer Service Group Leader, directing all customer service efforts on polyethylene both in the laboratory and in the field. He is a member of SPE and the Wire Association. Mr. & Mrs. Phelps and their three daughters make their home in Camargo, Ill.

Richard F. Kowal was born in Oil City, Pa., on April 10, 1930. He attended Alliance College (Cambridge Springs, Pa.) and Pennsylvania State University, receiving a B.S. in Chemical Engineering in 1951. After graduating, he went with Firestone Tire & Rubber Co., and served as a Process Engineer from 1951-1954. From 1954-1956, he was in the Army. Returning to civilian life, he joined U. S. I. in 1956 and has been with them since, working as a Technical Service Engineer and now as Customer Service Engineer—Polyethylene. Mr. & Mrs. Kowal have two children (a boy, 6, and a girl, 4), and reside in Villa Grove, Ill.

the other previously covered conditions are met. Any sign of an over-riding temperature indicates a possible trouble spot, and should be investigated.

If all the sources of oxidation mentioned previously are eliminated and the equipment is kept in a good state of repair, no oxidation problems should occur. If oxidation is occurring, however, one of the first noticed signs will be gels or fisheyes in blown or flat films, or pimple-like imperfections on heavier sections such as pipe, wire coating, heavy-gage sheet, and extruded shapes. These gels actually are particles with much lower melt indexes than the mass of polymer. The first thing to check when these gels or imperfections occur is the cleanliness of the whole extrusion apparatus.

Such imperfections may impair the appearance of the extruded product. In addition, especially in film, they can cause interruptions in extrusion resulting in a loss in operating efficiency. The gels or pimple-like imperfections are resin particles with softening temperatures different from those of the bulk of the molten polymer and, therefore, do not blend in with the mass. This phenomenon is illustrated graphically in Figure 1.

As mentioned, gels or hard particles can radically reduce extrusion operating efficiency. They may cause pin holes, loss of air, or complete rupture of the bubble in blown-film operation with a loss of material and a decrease in machine operating efficiency. Hard particles may gradually plug the screen pack, reducing the amount of free area for polymer flow-through. This is accompanied by an increase in back-pressure and a decrease in extruder out-put. If the back-pressure becomes very high, leaks around the adaptor flange may develop and the extruder drive could be overloaded. A pressure gage installed between the screw and the breaker plate will give an indication of the condition of the screen pack. The screen pack must be changed when the out-put drops off and extruder operating efficiency decreases.

The effects of oxidation on the properties of an extruded product are many, varied, and differ somewhat with the various resins. As shown in Figure 1, the effect on tensile strength increases with per cent oxidation. Elongation, however, decreases as soon as oxidation starts and gradually reaches zero. It is one of the first physical properties to be noticeably affected and, therefore, is suggested as the first check.

In general, the melt index decreases with an increase of oxidation. However, some resins undergo a slight increase in melt index as oxidation starts, followed by a decrease in melt index as oxidation continues (see Figure 1). This decrease in melt index results in gels or hard particles in extruded products, as previously mentioned. The density of the oxidized particles increases as per cent oxidation increases. If the density increase is significant, the extruded product will become more brittle with an accompanying decrease in tear resistance.

The electrical properties also are changed with the onset of oxidation, sometimes to the point where the insulation qualities are not acceptable. A typical example is the power factor. Virgin, unoxidized polyethylene approaches the ideal power factor of zero; as

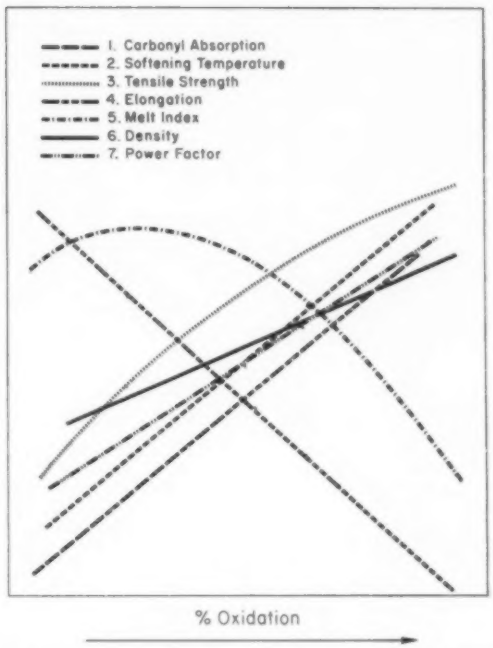


Fig. 1. Effect of oxidation on carbonyl absorption, softening temperature, tensile strength, elongation, melt index, density, and power factor.

oxidation increases, so does the power factor.

In summary, oxidation is a very undesirable side reaction prevalent in extrusion. Every precaution should be taken to minimize it by observing accepted methods of operation in conjunction with well designed and maintained equipment.

Another means to minimize oxidation is nitrogen blanketing of the polyethylene extruder feed, which has proved very effective in our laboratories. The simplest way to exclude oxygen is to replace it by establishing and maintaining an inert gas blanket over the resin entering and inside the machine. Any inert gas, such as argon or helium, is acceptable, but nitrogen was chosen because it is readily available and comparatively cheap. An inert-gas atmosphere also can be used to blanket the molten resin as it leaves the extruder. This expedient will reduce the build-up of oxidized polyethylene on the extruder die lips and, thus, in the final extruded product.

The hazard of oxidation during extruder shutdown periods can be averted by operating the extruder with a resin that withstands prolonged exposure to high temperature, such as occurs during shut-downs, without any danger of oxidation.

—The End

CARL ZEHR, *Pres.*,
Carl Zehr Co.,
Ashtabula, O.

Fabricated (Built-Up) Molds

Mold construction costs can be cut drastically for low-pressure glass-polyester moldings.

THE unique properties of the recently developed *low-bulk* glass-reinforced polyester molding compounds have opened the doors to new possibilities in product design. Because of the low-bulk feature, these materials, even with a relatively high glass content, flow readily in the mold. This property allows molding under low pressures (500 psi. average) in inexpensive fabricated molds similar to those commonly used in the rubber industry.

A comparison of construction costs between high pressure and fabricated molds is startling: a high-pressure phenolic-type mold prevalent in plastics molding which costs $2,000 can be constructed for molding at low presssure by the fabricated technique for only $400. Thus, the designer can get the benefits of molding—elimination of machining and finishing, and inclusion of molded-in details such as holes, ribs, bosses, inserts, etc.—even for short runs or parts (100 to 300), where previously the only feasible method of fabrication was through machining.

By utilizing low-bulk glass-reinforced polyester premixes such as the Thermaflow* materials, the designer can also obtain a number of advantages which are a little less obvious: (1). Modifications in design of the part at a practically insignificant cost in mold alteration; (2). A drastic reduction of time between the final blueprint stage and initial production; and (3). Desirable physical and chemical characteristics in the part—high strength, corrosion resistance, and excellent dielectric properties. The elapsed time between product development and actual production is cut to a minimum because a fabricated mold eliminates the need for making preliminary hand models of the part. In effect, the working models and production molds are developed and built simultaneously. By way of contrast, the cost of making changes in a machined mold becomes prohibitive, and so the mold usually has to embody the final part-design when it first is constructed.

In a fabricated mold, the various elements are shaped individually on standard machine tools from common materials, and then assembled in much the same way that a child makes a toy house from building blocks. The need for high-pressure molding (2,000-5,000 psi. average) has prevented the use of this technique with plastics up to now. To date, common practice in mold construction for the plastics industry has been dictated by the requirements of phenolic-type compounds. The use of high pressure requires heavy, extremely strong molds with specially-hardened surfaces. The female section of the mold has to be "hogged out" of a single large block of metal. The high cost of special materials, difficulty of machining, and the skilled labor requirements make these molds extremely expensive.

Mold Costs Derivation

Mold design for materials requiring high-molding

*Manufactured by Atlas Powder Co., Wilmington, Del.

pressures commonly require a single block of pre-hardened tool steel. The extreme hardness of this metal makes machining difficult. This mold construction technique is complicated further by the necessity of working in tight corners within a single solid piece of material. In addition, a great amount of skilled hand-work is required. The cost of pre-hardened tool steel itself is high, and material expense becomes significant because a high-pressure mold is usually at least six inches larger in all dimensions to withstand the greater forces and to provide room for steam cores.

Wherever possible, these high expenses should be eliminated by the designer through low-pressure molding. Fabricated molds incorporate relatively inexpensive and readily-available materials such as mild steel, high-density aluminum jig and fixture plate, and flat-ground stock. Hardened drill rods, dowels, and bushings, also standard items, can be used to build up the molded-in details of the finished part. The parts of the fabricated mold (sidewalls, pins, etc.) are incorporated into the finished mold by either welding or bolting, both extremely simple techniques. Since the moldmaker is working with only a flat, shallow piece of stock at any one time, machining becomes relatively simple with normal techniques and equipment. In addition, mold parts can be unbolted and removed readily so that repairs or changes in mold design become fast and inexpensive.

Advantages of Mold Fabrication Method

The fabricated mold technique is especially valuable in the design of a new product where a certain amount of modification is almost inevitable. The fabricated mold usually can be disassembled without difficulty and changed to conform with the redesign at a minimum of expense. On the other hand, the cost of making the changes in a machined mold usually is prohibitive, so the first mold usually has to be the final mold.

Production flexibility is another advantage offered by fabricated molds. Since most built-up molds are electrically heated, it is relatively simple to add more cavities as production demands increase. Addition of cavities is considerably more expensive with steam-heated high-pressure molds, where steam-tight seals between sections or complete replacement of the original mold would be required.

As a general rule, 90% of all pieces designed for compression or transfer molding with low-pressure polyester/glass compounds can be produced in built-up molds. Under some circumstances, however, conventional molds may be preferable or even necessary, as follows:

(1). Although built-up molds have been used for production runs of more than 150,000 pieces with no sign of failure, solid molds may be preferable for this long service. Because of the large number of parts produced, the cost-per-piece is not increased significantly by the higher cost of the heavier, more complex mold.

(2). When parts require extreme side-wall taper, solid molds may be required to withstand the outward thrust which tends to open up or spread a built-up mold.

(3). There are cases when a required radius is not

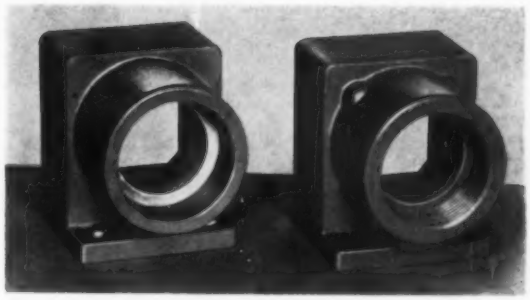


Fig. 1. Housing for an infra-red detector control.

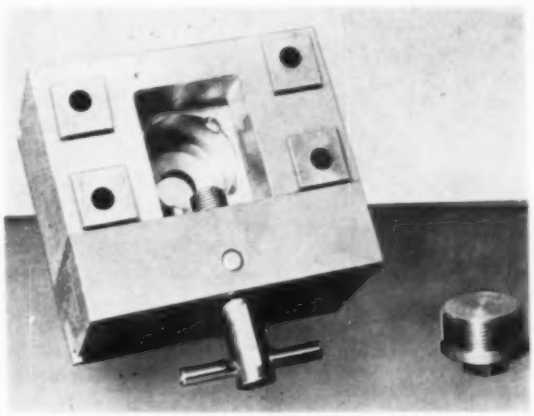


Fig. 2. Female section of mold for infra-red detector housing.

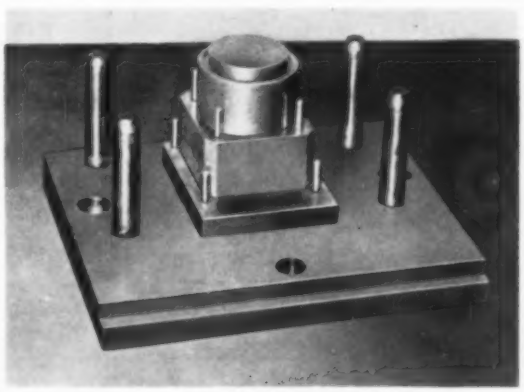


Fig. 3. Male member of mold for infra-red detector housing.

Fig. 4. Ultrasounder marine depth indicator.

practical in built-up mold construction. If the design cannot be changed, solid molds are recommended.

(4). A fine line that forms where sections of a built-up mold fit together may appear on a molded part. If this line is objectionable in a consumer item, solid molds should be used.

(5). When the design of the mold is so simple that shaping is no problem, a solid mold is preferable. In this case, the cost of the mold can be reduced by utilizing the less-costly materials which are used in built-up mold construction.

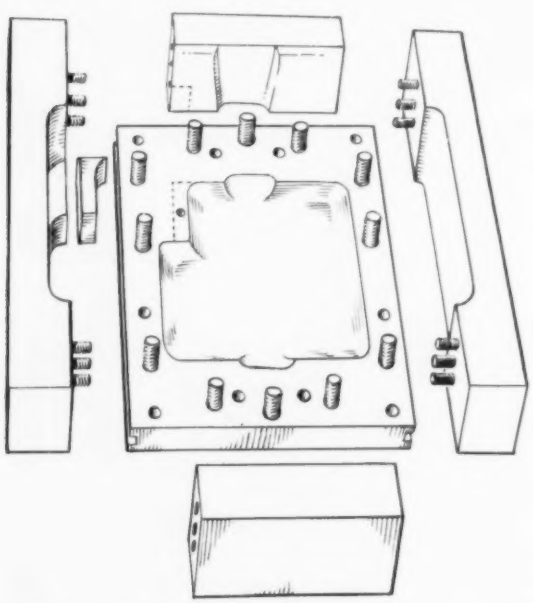


Fig. 5. Drawing of exploded female section of mold for marine depth indicator.

Examples

Infra-Red Detector Control

For example, one part required five mold changes made at a total cost of $44.00. The part (see Figure 1), a housing for an infra-red detector control manufactured by Euclid Electric & Manufacturing Co., required the addition of two holes on the inner surface, four bosses, one hole and reinforcing boss to accommodate a set screw, and elimination of threads in an opening. The changes included the elimination of the thread in the opening (right), and a reduction in the diameter dimension to accommodate a standard pipe size. Either the plain or threaded opening can be produced in the same mold. The holes in the base on the part (left) were drilled, not molded.

The female section of the mold for the infra-red detector housing was made in two sections (see Figure 2). The front section was a block of mild steel requiring no machining. The rear section was machined with relative ease because of accessibility of the work-

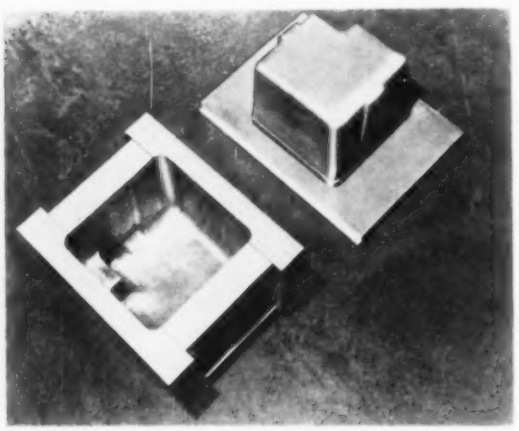


Fig. 6. Female (left) and male (right) sections of mold for marine depth indicator.

ing area. The two sections were bolted together. The tap shown inserted in the mold forms the thread, and is removed by turning during the curing cycle. The tap at right was used in the original design of the housing, and now is interchangeable in the mold.

The male member of the infra-red detector housing (see Figure 3) consists of three distinct sections which are screwed together. The pins on the bottom and center sections also are independent parts that are pressed into the main sections.

Total cost of the mold including alterations amounted to approximately $350. The cost of conventional-type tooling to produce a high-pressure mold for the same part would have amounted to $2,500, and the cost of subsequent design changes would have been prohibitive.

Marine Depth Indicator

A housing for a marine depth indicator, the Ultrasounder manufactured by Pearce-Simpson, Inc., Mi-

ami, Fla., (see Figure 4) is being produced with cost savings through low-pressure molding. The outer casing of this indicator is made from glass-reinforced polyester in a fabricated mold. Polyester was chosen because of its corrosion resistance, low molding costs and desirable weight and "feel" properties consistent with a high-quality product.

The male section of the mold was machined in one piece from high-density rolled aluminum, and bolted to the face plate. The female section (see Figure 5) consists of six distinct pieces (four sides, base, and a section welded to a projection on one of the sides) either bolted or welded into a complete structure. Mold production was facilitated by the ability to handle each of the six pieces of the female individually. Machining of the individual parts required approximately one-sixth the labor and time needed for a comparable, fully-machined mold. The entire mold (see Figure 6) was produced for $600. Cost of a comparable high-pressure mold was estimated at approximately $3,500.

Terminal Board Cover

A single-cavity fabricated mold, see Figure 7 (bottom), for an aircraft terminal board cover was supplied for approximately $300, as compared with about $1,100 for a similar high-pressure mold. The part was previously machined from a laminate, see Figure 7 (top). In addition to savings in the original mold cost, the customer obtained drastically reduced costs when a design change in the part became necessary. If a high-pressure mold had been used, the redesign would have necessitated scrapping the male part of the mold, at a cost of $600. The modification was made in the fabricated mold at a cost of only $80 by switching to glass-reinforced polyester. The manufacturer also was able to attain a 60% weight reduction through use of glass-polyester premix, and also obtained improved strength and dielectric properties, plus flame retardency.

—The End

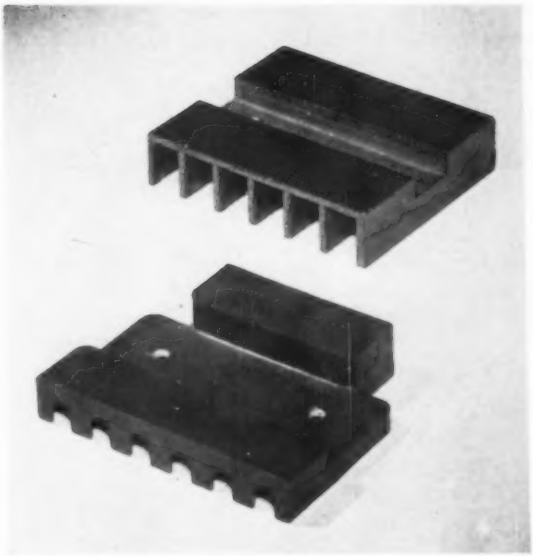


Fig. 7. Mold (bottom, for aircraft terminal board cover. Part previously was machined from a laminate (top).

The Car of Tomorrow

The outside of the car has complex epoxies parts formed in plastic molds.

To prepare a working prototype of Ford Motor Co.'s Levacar Mach I, Wettlaufer Engineering Corp. of Detroit used virtually every method of tooling, patternmaking, and molding known in the automotive industry. The result, a full-scale, wheelless, air-propelled vehicle, consisted largely of aluminum on the outside surfaces and epoxy on the inside.

From a Ford-designed clay model, Wettlaufer constructed the prototype in less than four weeks. Such speedy construction reportedly would have been impossible without plastic.

The headrest, back, seat, armrests, floorpan, and curved front portion in the dashboard area is a one-piece epoxy-glass cloth laminate. Ren Plastics, Inc., supplied the desired epoxy formulation. Only under the seat is any extra support for the intricately-contoured laminate. Plaster was used for laying up the one-piece car interior laminate, while zinc-alloy dies were used for metal forming and plastic molds for molding areas. In critical areas of the Levacar, such as edge moldings with combinations of arcs and curves, epoxies were used both in the mold and the molding.

According to Wettlaufer, use of epoxies saved both time and cost. The one-piece construction would have been impossible with metal. Further, the epoxies eliminated the necessity of additional support which metal would have required in several places.

After the laminate was complete, it was metallized and chrome plated in the necessary areas. Upholstery for back, seat, headrest, and armrests was then mounted on the plastic.

The revolutionary car has been given a trial run at the Rotunda, Dearborn, Mich.

—The End

Guest Editorial

W. P. GOBEILLE, *Mgr.*
Plastics Operation
American Motors Corp., Detroit, Mich.

Plastic Automotive and Tooling Applications

WE have just completed a machine load study for our plastic division, and we find that our production of plastic parts has quadrupled in the last four years. This does not include some of the really volume jobs which are coming up.

American Motors feels that it is in a good position to capitalize on a long and pioneering history in plastics. We have led the way in the increasing size of plastic parts, and large parts will surely be the large-volume items in automotive applications. We now operate injection molding machines in sizes from very small to those capable of producing 12-pound shots. Since molding machines are rated in ounces, our plant represents over 2,000 ounces of molding capacity. This is backed up by a very extensive complement of decorating and secondary equipment.

There is special interest in automotive uses for plastics because automobiles are the great multiplier. Seven- or eight-million cars a year, most of which have four doors, make 25- to 30-million arm rests, inner door panels, kick-plates, etc., for a total of over 100-million molding and garnish parts. And these are large parts requiring intricate molds and large machines.

Several meetings have been held recently in Detroit, displaying a wide range of molded plastics parts used in European cars. These include instrument panels, garnish molding, door and window handles, and duct and heater parts—to mention only a few. The applications now in use on the Volkswagen, related to our compact cars in weight, would exceed 40 pounds per car. The Fiat is making extensive use of molded plastic parts on their 1960 car. U. S. average car usage will be about 20 pounds per car in 1959.

Our plastic laboratory made a study of applications which indicated functional improvements, cost savings, or both—in areas where there was no question of plastic suitability. Being as conservative as possible, they arrived at over 100 pounds. This was tailored down to 60 pounds before being presented because we felt that we would have been straining the credibility level of our engineering executives.

A recent report shows automotive expenditures for research to have increased 32% since 1957. Of course, some large part of this went to produce the Big Three's Rambler-type cars, but I can tell you that our company's expenditures for plastic research and development have quadrupled in the last two years. Believe me, this will not be spent to create "planned obsolescence." Our company's policy is not to change design for change alone.

When you look at our new 1960 models, you will not see a drastic difference. But when you examine more closely, you will note hundreds of changes made to give greater benefit to the consumer. We believe styling should strive for the classic approach. You may not like the Volkswagen, but this is classic styling. The Citroen is produced with functional changes only, the basic styling staying in effect for 10 years on their last model. And this is with advanced engineering.

Moldmakers may have hailed "planned obsolescence" for creating a demand for more new molds, but we think it has not worked that way. The tool bill gets so big that other methods are employed which incidentally yield a higher cost part. We have lost several traditional and conventional plastic applications recently because of this effect.

We are certain that you have given thought to the inroads made in your business by the so-called "low-cost tooling." We have seen some moldmakers rush to meet this threat by reducing costs through less effective methods and cheaper materials. The way to meet the challenge of automotive plastics parts is by better steel, better molds, more intricate design, and more craftsmanship. The least expensive part from any existing design is made from the very best mold!

There is an old Italian proverb that goes: "Good things cost less than bad ones." To meet the requirements of mass production, we must have more precision and more intricate design. For automobiles, we must have larger parts. You have all seen the Ford front seat side-shield. Here is a part requiring complex molds and precision molding, but yielding a functionally better and lower-cost part. We are currently testing an application which I believe is on all cars in steel that, if adapted by all, would call for 40-million pounds of plastics per year.

We have had a spate of new higher-physical plastic materials available. This is what is really triggering the increase in plastics applications. Thermoplastic molding materials which will take 380° F; some with twice the rigidity, better impact strength, and solvent, acid, and base resistances; high tensile strength (perhaps approximately that of white metals in usable wall sections)—we all welcome and stand ready to spend the research time and money to develop them.

The challenge is there, and we are spending money and talent to hold up our end.

In addition, be a plastics salesman. One of the most serious hurdles for us is consumer resistance. This extends even to our own executives. Never miss an opportunity to sell good plastics to your friend, neighbor, or your wife.

—The End

Gooch Replaces Johnson on PT's Editorial Advisory Board

As a step in his gradual relinquishing of duties aiming at his retirement in 1963, E. H. Johnson has resigned from Plastics Technology's Editorial Advisory Board, a position he had filled since June, 1955. In accordance with his recommendation, he is being replaced on the Board by Kenrick J. Gooch, Assistant Division Engineer for the Mills & Calender Division of Farrel-Birmingham Co., Inc., Ansonia, Conn.

Mr. Gooch was born in Maine in 1919, and received a B.S. in Mechanical Engineering from Tri-State College (Angola, Ind.) in 1941. From 1941-1942, he was a student engineer at Farrel-Birmingham, and left to serve with the Navy from 1942-1945 as a research and design engineer. Returning to F-B in 1946, he worked as a design engineer in the company's sugar mill division until 1948; design engineer in the roll grinder division from 1948-1950; lubrication engineer in the engineering department from 1950-1954; sales engineer for the mill and calender division from 1954-1956; and was named to his present position in August, 1956. He is a member of ASME and SPE. Mr. & Mrs. Gooch have three children, and reside in Bethany, Conn.

In his work on our Board, Mr. Gooch will specialize in the field of plastics calendering.

C. C. LUCE, *Chief Chemist,*
Molded Fiber Glass Research Co.
Ashtabula, Ohio

Clay Fillers in Structural Reinforced-Plastics Parts

How clay-type fillers help a manufacturer meet high physical specifications for his products.

As the use of reinforced plastics as a structural material increases, their ability to meet definite physical specifications becomes more and more critical. Most plastics manufacturers and fabricators welcome this trend. They realize that in the long run, reinforced plastics can hope to compete broadly with more conventional structural materials only through the development of products having greater strength, durability, and versatility.

Suppliers to the plastics industry, as well as plastics molders and fabricators, are continually investigating the many variables in plastics production in order to determine their influences on resulting physical properties. Among these variables are the resins, reinforcing materials, and all the techniques of production. One of the most important, but least understood variables having a definite influence on the physical properties of the end-product is the filler material.

Often, plastic fillers are used merely as extenders to reduce the resin content and, therefore, the cost of the product, without excessively degrading it. However, the more progressive reinforced-plastics manufacturers are realizing the importance of filler materials as a means for improving the physical properties of their products.

For instance, the Molded Fiber Glass Companies have standardized on kaolin, or China clay, as their basic filler material to be used in all press-molded parts requiring high physical properties. The MFG companies have found that, when properly employed, this filler material imparts better impact resistance; gives smoother, denser surfaces; and reduces crazing. Three of the six affiliated MFG companies are using various types and grades of the pulverized inert mineral.

Auto Bodies

Molded Fiber Glass Body encountered considerable difficulties in meeting certain increased physical property specifications for sports car body parts with existing formulations and molding techniques. Some of the more intricate parts made from earlier formulations, which included a surface-coated calcium carbonate filler, had a tendency to craze. In addition, the laminate did not consistently meet the reverse-impact requirement specified by the customer. Difficulty also was experienced in meeting 180° flexural modulus specifications.

Experimentation with various fillers led to the discovery that a 29-35% loading with a relatively coarse, surface-modified kaolin product resulted in production parts which consistently met the exacting standards. In fact, these parts frequently exceed the critical reverse-impact specifications by as much as 40-50%.

Table 1 compares the manufacturer's specifications for the sports car body panels with a random test sample of a molded laminate filled with a 29% loading of ASP 403*, a hydrated aluminum silicate (kao-

* Product of Minerals & Chemicals Corp. of America, Menlo Park, N. J.

Table 1. Comparison of Specifications and Actual Physical Properties of Molded Laminate Panel.*

	Customer's Specification		Test Panel Values	
Reverse impact, in. of drop	8		10	
Tensile strength, lbs.	15,000		19,200	
Izod impact strength, lbs./in.	None		25.8	
Flexural strength, lbs.:				
At room temperature	25,000		40,100	
Wet	None		35,400	
Retention, %	70		88.2	
	10 sec.	100 sec.	10 sec.	1000 sec.
Flexural modulus:				
At room temperature	1.30	None	1.77	1.66
Wet	—	—	1.40	1.24
Retention, %	70	—	79.2	—
180°	0.50	None	0.75	0.63

* Made from 29% resin-filler (Selectron 5158, ASP 403) mix with normal 9:1 ratio of resilient resin to styrene, with 0.8% BPO as catalyst. Molded at 235° F. with press time cycle of three minutes.

Table 2. Typical Chemical Analysis* of Unmodified Hydrated Aluminum Silicates

Silica (SiO_2)	45.4%
Aluminum (Al_2O_3)	38.8%
Iron (Fe_2O_3)	0.3%
Titanium (TiO_2)	1.5%
Calcium (CaO)	0.1%
Sodium (Na_2O)	0.1%
Potassium (K_2O)	Trace
Loss on Ignition	13.8%
	100.0%

* Average values established for typical samples.

and this side, which represents the outer body surface, is placed face-down on the metal ring. A ½-pound, 1½-inch diameter steel ball is dropped on the center of the panel from varying heights. A red dye is wiped on the reverse side of the panel, and then wiped off. Minute surface fractures are penetrated by the dye, leaving a mark or star. Specifications and test values indicate the height of drop sustained without visible surface failure.

As a result of the tests, MFG engineers specified the surface-modified clay as the standard filler material for production runs of these parts. The final formulation is shown in Table 1: a 9:1 ratio of resilient resin to styrene; 0.8% BPO as the catalyst; and a filler loading of 29%, by weight, of the resin-filler total.

Table 4 gives mixing instructions for 600-pound production batches of catalyzed resin containing 29 and 35% filler. The body company employs two-hp. Lightning mixers which drive eight-inch Conn impellers at 431 rpms. Brookfield viscosity of the 29% mix is 1,800 cps. at room temperature. Dies are steam-heated to 240-250° F. Press cycles vary from ½-4 minutes, and molding pressure is 150 psi.

Of course, viscosity and thixotropy are important considerations in press molding. Even in deep-draw and intricately-shaped molds, however, MFG Body has experienced no trouble with the clay-filled mix. The batches normally are used the same day, but occasionally they must be held over the weekend. The inert filler has less catalytic effect than other fillers used, and does not settle out. Pot life of the mix is sufficient to last well past the weekend pro-

Table 3. Physical Characteristics of Hydrated Aluminum Silicate Fillers Used by MFG.

	ASP 100	ASP 103	ASP 105	ASP 400	ASP 400
Type of modification	None	Cationic surfactant, organophilic	Cationic surfactant, hydrophobic and organophilic	None	Cationic surfactant, organophilic
Particle shape	Thin flat plate →			Thin flat plate and laminated plates →	
Average particle size, microns	0.55	0.55	0.55	4.8	4.8
Oil absorption (ASTM D281-31)	35.41	30-33	28-31	28-32	25-28
Color, G-E Brightness, %	86.5-88	86.5-88	86.5-88	80.5-83	80.5-83
Specific gravity	2.58	2.58	2.58	2.58	2.58

lin). Chemical analysis of this surface-modified, inert mineral, and its physical characteristics are given in Tables 2 and 3, respectively.

The various tests cited in Table 1 should be familiar to persons in the plastics industry with the possible exception of reverse impact. This test, borrowed from the coatings industry, was specified by the sports car producer. It is an attempt to simulate the effect of a stone striking the underside of a fender or body panel, and tests the ability of the top surface to resist such impact.

In the test, a one-foot square, 0.100-inch thick laminated panel is placed on a five-inch diameter ring. One surface of the panel contains a 30-mil veil mat

duction shut-down. Also, it is believed that the characteristic thixotropy (desirable in most deep-draw molds) of this material in certain liquid mediums permits faster press closure, better mold fill-out, less washing of glass fibers, and less tendency for the resin to escape after die closure. The plate-like structure of the filler material also appears to impart a smooth, hard exterior surface to the finishing part.

Further experimentation with kaolin fillers at MFG Research Co. indicated that surface-modification of the filler was not always essential. The modified ASP has been replaced subsequently in the auto body laminates with the unmodified ASP 400 (see Table 3 and 4) with no loss in physical properties. Figure 1 shows

Table 4. MFG Mixing Procedures for Standard Resin-Filler Mixes

Filler	Stage	Material			Mixing Time, Min.
29%	First	330-lbs. Resin	+	50-lbs. ASP 400	5
			+	50-lbs. ASP 400	5
			+	50-lbs. ASP 400	20
	Second	Zelec Styrene	+	BPO catalyst	5 10
				Complete Cycle:	45
35%	First	342-lbs. Resin	+	50-lbs. ASP 400	5
			+	50-lbs. ASP 400	5
			+	50-lbs. ASP 400	5
			+	50-lbs. ASP 400	20
	Second	Zelec Styrene	+	BPO catalyst	5 10
				Complete Cycle:	50

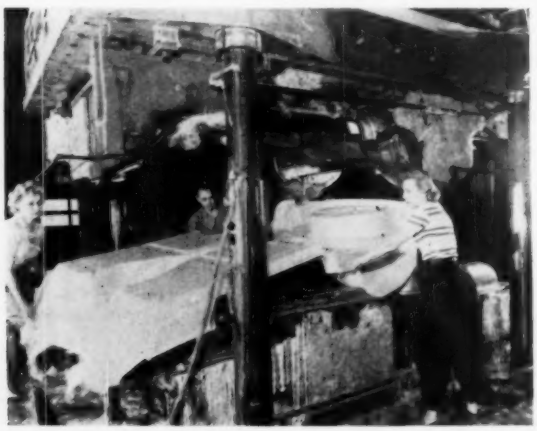


Fig. 1. Finished auto underbody being removed from molding press shows size and complexity of part that meets rigid physical requirements.

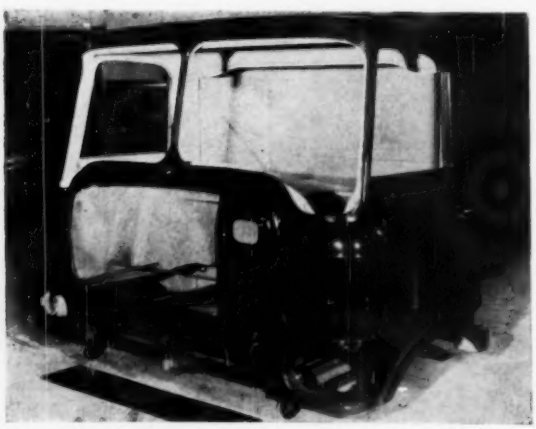


Fig. 2. Truck sleeper cab of reinforced-plastics.

Fig. 3. 15-foot MFG boat made of fiberglass-reinforced plastics.

Fig. 4. Dies of lap strake boat show potential molding problems.

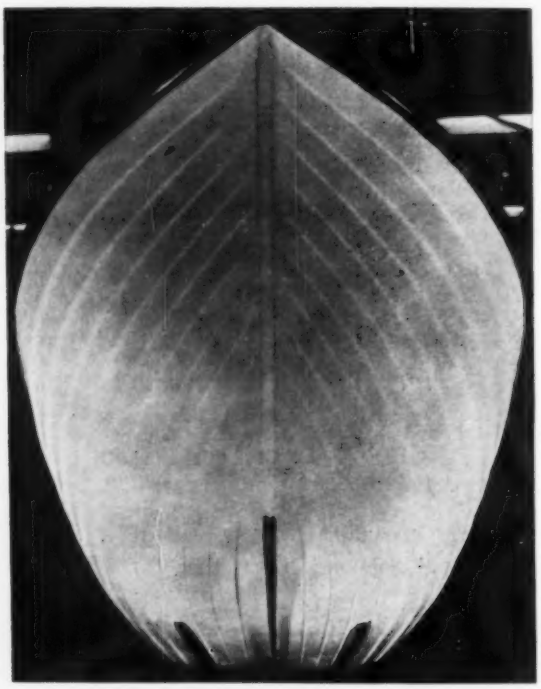


Fig. 5. Finished hull of MFG boat shows strakes to be free of cracks and crazing.

the molding of an auto underbody.

The MFG Body Company specifies the clay filler in a variety of other molded parts requiring high physical properties. An example is the lightweight laminated truck cab shown in Figure 2.

Boat Hulls

In initial production runs of press-molded boat hulls, calcium carbonate was specified as the filler material to attain a high white finish. The MFG boat is of lap strake design, (see Figure 3) however, and crazing on outside radii of the laps was a problem. The surface modified ASP 403 was tried here and reduced shrinkage sufficiently to prevent crazing.

The MFG lap strake design gives the boat a greater lateral stability than a smooth hull. As might be suspected in molding such a shape, the closing dies tend to pull the reinforcing fibers away from the extreme outer edges of the strakes, leaving resin-rich areas at these points (see Figures 4 and 5). Due to lack of reinforcement and the natural tendency of the polyester resin to shrink, these areas tended to develop crazing. However, the use of a 33% loading of ASP 403 apparently absorbs enough of the reaction heat to reduce the peak exotherm, thus preventing excessive shrinkage. This 33% loading is now standard in the production of 13-, 15-, and 17-foot MFG boats made in matched metal dies.

A minor limitation of the kaolin filler material is its off-white color. This was not a problem in parts which were to be painted, but in some applications, where an all-white natural finish is desired, or when bright colors are called for, calcium carbonate still is used as a filler. In most critical applications, however, MFG is satisfied to accept a slightly off-white color when accompanied by increased flex strength, modulus, reverse impact strength, better surface, and the elimination of crazing.

Tray Production

Another approach to the color problem has been tried by Molded Fiber Glass Tray Co. By using finer particle-size aluminum silicates, ASP's 100, 103 and 105 (see Table 3), the Tray Company begins with an almost-white product, and requires less pigment to produce the 12 colors. Titanium dioxide is added to make the white tray.

The trays are used in cafeterias; in the food processing industries; and in chemical, pharmaceutical, and biological dryers. The basic reason for using the clay filler is to obtain a smoother and more dense surface for maximum resistance to chemicals, abrasion, alkalis, and acids. Surface-modified clays in the 100 series are used, rather than the unmodified version, for better wetting and forming characteristics.

Since surface hardness is a primary requirement of trays, MFG Tray Co. constantly is striving for better results. Their production trays currently have a Barcol hardness in the 45-50 range. However, the most recent experiments indicate that they can increase this value to 60 by using Satintone, a calcined aluminum silicate produced primarily as an extender pigment for the paint industry.

—THE END

Dacron Reinforcement Improves Prosthetic Devices

For the past year and a half, the Veterans Administration's Prosthetics Center has been using non-woven Dacron reinforcement for better socket and stump fitting in artificial limbs. Troy Blanket Mills' Troytuf makes reinforced plastic prosthetic devices structurally stronger, easier to prepare or modify, and better fitting.

The socket, which is in contact with the skin, is the most critical section of an artificial limb. Because not only comfort, but the psychological effect of appearance, is important, easy modification and renewal of original finish is desirable. Experimentation indicated that Troytuf was the best available reinforcement. Because it was mechanically interlocked, it would not cause crazing or cracking which had occurred with such materials as wood flour, cellulose fiber dipped in acetone, and acrylics. In addition, the laminate could be modified and polished, sanded or smoothed back to its original finish. Unlike previously used nylon stockinette filler, whose protruding ribbed edges were a source of irritation, Troytuf had no rough edges.

The successful application of polyester fiber blanket can be attributed to its similarity to the polyester laminate resin. This similarity has improved the process for adding material. Whereas this operation formerly consisted of smearing the filler on the build-up area, Troytuf has simplified it to a patching process. After the area is roughed up, a piece of Dacron is dipped in the laminate resin and applied. It adheres immediately.

In production, the blanket is first trimmed to the dimension of a standard mold and stitched to form a sleeve. After being bound to prevent slippage, the sleeve is enclosed in a heat-sealed, polyvinyl alcohol sheet which acts as a receptacle and retainer for the liquid resin. Resin is poured through a funnel and manually distributed. "Stringing" the resin helps to distribute it evenly and to remove air pockets. If an air-cured resin has been used, the device is removed from the mold. Otherwise, it is oven-cured before removal.

PLASTICS TECHNOLOGY

EXPLORING FABRICATION TECHNIQUES

By L. J. ZUKOR, *Engineering Editor*

Powdered Polyethylene . . .

. . . compounded to uniformly small particle size, is being used in flame-spraying, casting, sinter-forming, and fluidized bed coating. These operations require that the resin particles be spherical (or as near round as the manufacturing processes will allow), dry and free flowing (non agglomerating), stable at fluxing temperatures, and resistant to environmental stress-cracking (ESC).

Of the above processes, fluidized bed coating is presently attracting more interest and consuming more powdered resin than the others combined. Yet this process, though more than 60 years old, is the least familiar to plastics engineers.

Fluidized bed coating employs the principle of suspending a finely-divided solid in a vertically moving stream of gas. The simplest form of fluidizer consists of a tank divided horizontally by a porous membrane into two compartments; the lower closed and the upper open. The membrane (separator) must retain the powdered resin in the upper chamber and must also be sufficiently porous to permit the diffusion of gas (compressed air) uniformly and at a predetermined rate from the lower (plenum) chamber. This mechanism was conceived and is used in many phases of chemical engineering where it is known as a sparger.

The fluidized powder resembles a low-boiling liquid, in that discrete resin particles circulate in a turbulent stream. The spheres, being of low-density, are held aloft by a force component or dynamic "lift", which is greater and opposes the pull of gravity. The spherical shape is important since the particles should present the same or equivalent surface areas to a constant-pressure air stream and because a spherically-shaped object hitting another similarly shaped object will roll or bounce away. Uneven objects with sharp protuberances will tend to agglomerate. Still another mechanism is at work —static electricity. Static charges are identical on all particles and, when controlled to a small value, help to keep the particles separated (like charges repel).

When an object is introduced into a properly fluidized bed, it moves freely and meets with negligible resistance from the suspended resin particles. Articles to be coated with polyethylene or other polymers are preheated to a temperature above the melting point of the resin, then lowered into the fluidized bed. Irregularly shaped or heavily undercut articles should be agitated slowly to ensure complete resin coverage. The duration of dip depends upon the shape of the part, coating thickness desired, and initial preheat temperature.

On removal from the bed, the coated object initially has a frosted appearance. With polyethylene, residual heat is often sufficient to level and fuse the coating to a smooth, non-porous clading. Annealing may be used to fuse the coating further. Since this process depends on the object retaining its heat during the time of transfer from the oven to the fluidized bed, thin-walled sections (less than 0.032-inches) may present difficulties.

Parts must be suspended during the dipping operation. Where the holding fixture makes contact with the part, it leaves a bare spot. When polyethylene is used, this is easily filled by using some powdered resin and fusing it to the object with a blast from a hot-air gun. If uncoated sections are desired, they can be masked. Excellent "stop-offs" can be obtained using Teflon or Kel-F masking tape.

Fluidizers range from very simple pieces of equipment to complex units containing ultra-sonic vibrators. However, design and construction of the diffusion-plate, more than any other factor, determines whether or not a fluidizer will perform efficiently. Air for fluidization must be dry and oil free.

Some fluidizer manufacturers supply a self-contained

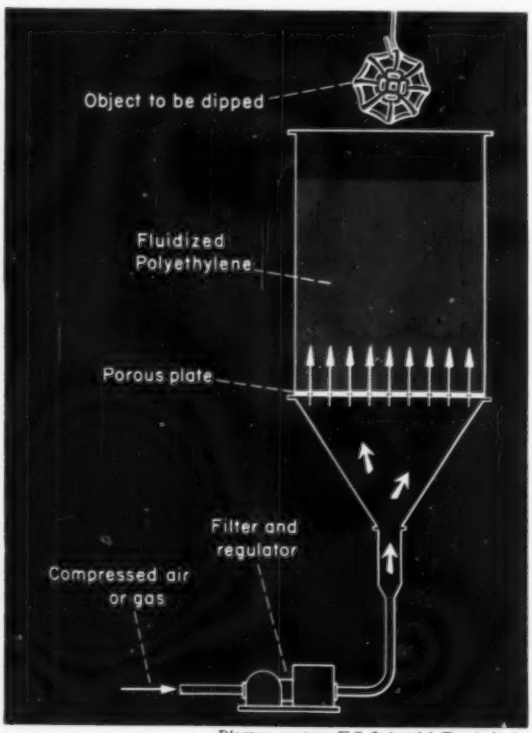
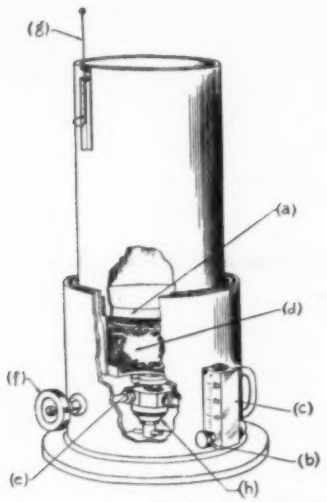


Diagram courtesy: U.S. Industrial Chemicals Co.



Drawing courtesy: Armstrong Products Co.

(a). ceramic distributor plate, (b). needle valve (air flow), (c). flowmeter (C.F.M. air), (d). dessicant dryer cartridge, (e). turbine vibrating unit (air operated), (f). frequency regulating valve, (g). reed (frequency indicator), (h). pressure regulator (reducer).

blower system; others make provision for connection to the plant air system.

The handling of any powdered material usually presents operational, health, and safety hazards. To guard against these, good housekeeping practices should be maintained. Fluidized bed tanks should be hooded to prevent air-borne dust from settling over the internal structure of a building, entering the plenum chamber, and clogging the diffusion-plate. These not only could cause a series of explosions, but are inhaled by personnel. For proper operator safety and comfort, a good exhaust system and dust collector pays dividends.

Diallyl Phthalate . . .

. . . a familiar compression and transfer molding compound (see our May 1959 issue, page 38) is presently making its debut as a laminating resin. Here, its greatest advantage is its ability to polymerize fully (cross-link) at low pressure and relatively low temperature. Unlike condensation resins which split-off water as polymerization advances, diallyl phthalate resins yield no volatile by-products as they cure. Laminates of this material exhibit excellent abrasion and heat resistance, and are unaffected by moisture, solvents, and other chemicals.

Dapon (diallyl phthalate) prepolymer, a solid material developed in the laboratories of Food Machinery & Chemical Corp., is described by them as a thermoplastic prepared by reacting the monomer with itself to form a linear polymer. For paper or cloth impregnation, powdered resin is dissolved in a ketone (or mixed solvent including a ketone) along with small amounts of monomer, peroxide catalyst, and internal parting agent. Proper formula adjustment and drying will produce an extremely flexible, dry, saturated stock of high resin content which has any desired flow characteristic. Proponents of this system claim that many thicknesses of saturated stock can be laminated to a substrate to obtain a finished resin thickness of 20 mils without crazing or cracking.

When heated, the catalyzed resin cross-links to form a thermosetting, infusable, insoluble polymer which is not affected by acids and bases, nor by organic solvents. During its cure cycle DAP resin becomes a fluid; thus adequate flow is possible at very low laminating pressure. Gelation takes place rapidly enough to prevent migration loss to the edges of the laminate. Because volumetric shrinkage during cure is less than 1%, it is possible to produce flat and undistorted laminates.

Alpha-cellulose and viscose rayon papers are being successfully impregnated with DAP resin to be used as clear overlays in laminating. Other printed and decorated papers have also been impregnated with the resin. Here, it is important that the printing inks used be unaffected by both the monomer and solvents which dissolve the resin. Impregnation can be accomplished by conventional means ranging from hand dipping and brushing to automatic horizontal and vertical coating. Manual impregnation is usually confined to items such as wood veneers that do not lend themselves to reeled automation. In the impregnation process, the drying operation must be carefully controlled. Correct temperature control is necessary to prevent resin cure during solvent extraction. Evaporated solvent can usually be recycled if a proper solvent recovery system is employed. The drying temperature and time will be determined by the type and amount of solvent to be removed.

DAP-impregnated papers and veneers can be laminated to almost any core material, such as plywood, hardboard, gypsum board, and specially treated metallic surfaces. In low-pressure lamination, the moisture content of the base material is fairly critical. If too high, the internal pressure caused by steam can rupture or blister the laminate when the press is opened. Some base materials such as hardboard and plywood usually require balancing to compensate for the slight shrinkage that occurs in the resin. Without the balancing layer, these laminates will warp when pressure is released.

Two methods for curing are used, both requiring the use of a multiple-opening platen press. Laminate layers can be cured either "face-to-face" using a polishing plate finished on both sides, or "back-to-back" using two polishing plates finished on one side only. The latter method is preferable, since the conductivity of core material is generally poor and could result in undercure of the resin. Both aluminum and stainless steel cauls can be used with DAP resin, coated or baked with a silicone release. Further, the impregnating resin has a "built-in" release agent.

As noted above, DAP is a low-pressure laminating resin. Pressures as low as 50 psi. have been employed successfully, although 100-250 psi. pressures are used for most laminates; complete resin cure occurs at temperatures from 280-340° F. At the lower temperature, cure occurs in 50 minutes which is shortened to 2½ minutes at the higher temperature. No adverse effects have been observed when a laminate has been cured for one hour at 350° F. —THE END

Edited by:
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Reinforced Plastics

Gun Fight At The Reinforced-Plastics Corral

THE field of reinforced plastics recently has experienced a wave of new resin spraying guns, pneumatic and hydraulic, both with and without the added feature of chopping rovings into the resin stream. Consequently, there has been a flood of published reports from each manufacturer extolling the virtues of his particular gun.

Unfortunately, proper evaluation of each of these guns is a most expensive operation for the reinforced-plastic molder. To try to effect this evaluation solely from the printed data is impossible, as most of them compare apples to oranges. The salesman's happy case histories of well-satisfied users are of doubtful value since not every molder desires the same end-result. While some molders seek minimum weight and greater strength, others place utmost importance on either low labor or material costs, while still others seek a technique which will give the greatest chance for uniformity from product to product.

It seems to me, however, that there is a simple way of performing an experiment which should be of interest both to the manufacturers of the guns and to present and prospective purchasers. At least, it would be a means for establishing a common denominator, and perhaps lay the ground-work for even more detailed studies.

Suppose we took a set of molds for a 14- or 15-foot boat, preferably including a deck which would have some intricate contour such as might be expected in normal products. Then, let us establish a set of close standards of surface finish, hull thickness, total boat weight, tensile and compressive strengths, and resin/-glass ratio. Then, let us turn this mold over to a well-trained contact molding crew and have them manufacture hulls and decks for a full week. During this time, accurate records of labor and material would be kept including all material preparation, equipment clean-up, and all re-work necessary to pass boats through inspection. By running the project for a week, we can level-out production spurts and attain a more nearly normal level of productive effort.

Now, let us turn the same mold over to a well-trained crew using a resin spray gun without fiber chopping and have them operate for the same period of time and accumulate the same records. Once again, go through the same program, but this time with a trained crew using a spray gun with a fiber chopper.

When the foregoing test period has elapsed, we should have some fairly good records on the number of hulls each technique produces and the labor and material costs necessary to produce same. This would give us an indication of which technique is most productive from the standpoint of labor and material. Concurrently with the foregoing program, we should run an unbiased series of tests on these very boats to determine which technique produces the strongest boat, the most uniform in thickness, the least re-work, etc.

It should be remembered that labor rates, overhead, and G&A expenses are individual plant functions, and should not be included as part of the experimental costs. From these tests, a molder at least could select the general classification of equipment in which he is interested, if indeed he is interested in any at all and, thus, he need only investigate that equipment or technique which is within his category of interest.

As an outgrowth of this program, it may be of additional interest and value to perform the same experiment again with unskilled crews. It is possible that one system may have a definite advantage in length of learning time, and the learning curve resulting may prove significant.

—THE END

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Moldmaking & Tooling

Mold Surface Finishes and Their Standards

THIS article is intended to acquaint the moldmakers and their customers with the complexity of mold surface finishes and their components. Let us first discuss a few of the technical terms recognized by the American Standards and presently used in the industries, although not to the extent they should be used.

A mold surface may be produced by various machine operations; casting, blasting, housing, plating, burnishing, and polishing. A nominal surface is commonly known as the theoretically accurate design, shaped as usually shown, and dimensioned on a drawing or a specification.

Any deviation from the nominal surface is an irregularity, including roughness and waviness. Roughness consists of finely-spaced surface irregularities whose height, width, and direction establish the surface pattern. Any irregularities produced by cutting edges and machine feed are known as roughness. The height is rated in micro-inches (symbol Mu or U)—the arithmetical average deviation from the mean line. The width is rated in inches as the maximum permissible spacing between repetitive cuts of the pattern.

Waviness involves irregularities of the nominal surface which are of greater spacing than the roughness. These irregularities may be the result of such factors as machine deflection, warping, heat-treating, vibration, etc. The height of the waviness is rated in inches from peak to valley. The width also is rated in inches as the spacing of adjacent waves.

The lay is the direction of surface pattern produced by tooling marks or grains (casting) determined by the production method used. The direction of the lay is covered by symbols of standardization.

Flaws are irregularities or imperfections occurring in one place or at infrequent intervals in the surface, such as a scratch, hole, pit or peak. They are not typical of the surface, and usually are caused by conditions other than normal machining operations or processes. Acceptance or rejection of a surface containing such a flaw or flaws is strictly a matter of the judgment of the inspector.

Designation of surface characteristics on a critical surface and the quality of surface desired, should be indicated in micro-inches (one micro-inch being one millionth of an inch). There is another standard designation RMS (Root Mean Square average) used mostly in the electrical and casting industries. Recommended roughness height ratings in micro-inches are 2, 4, 8, 16, 32, 63, 125, 250, and 500.

The finish of any surface can be determined accurately by a tracer-type instrument such as a Surfindicator, Profilometer, and others, using the values of the roughness comparison specimens and the proper stylus (tracer) on the instrument for the checking. These specimens should be used only as a determination as to whether or not the instrument is in proper working condition. They should never be used as a visual comparison of one surface to another. The end-result of such an inspection may vary greatly in accuracy and uniformity due to the human element involved.

In view of the aforementioned points, I am certain that there is a great and dire need for improvement in the cooperation and communication between customer (captive or custom molder) and moldmaker, with regard to the finishes required on the mold components and, ultimately, on the molded part. It most certainly will reflect on the cost of the mold, either upward or downward. The finishes may vary greatly depending on the molding material selected for the end product. Some unnecessary and ridiculous demands are sometimes made in this respect, such as mirror finish on the male components, etc.

High polish is necessary only when clarity of product

(*Continued on page 49*)

Edited by:
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Compression & Transfer Molding

A Data Sheet — What Ho!

LOOK at any data sheet given by a material manufacturer and ask yourself how much it means to you. Depending on the role you play in the engineering or production of a plastic item, you will examine the pertinent information given in the data sheet and utilize the information as a guide. In the main, the data sheet is the initial criterion which describes the properties of the plastic molding compound to be used. The sales engineer, the tool engineer, the estimator, the material control man, the production manager, the chemist, the research and development director, or any other person having key responsibility within the structure of a company—all rely on the accuracy of the particular data with which they are concerned. Smaller companies need diversified men who can interpret any part of the data sheet. Questions arise: Are the given data useful? Are they meaningful?

This article will dwell briefly on two of the mechanical properties included in a thermosetting data sheet; namely, impact strength and tensile strength. First, let us define "mechanical properties" as those properties which measure forces in action against mass. These measures usually are in units of exerted pressure (tons, pounds, etc.) per unit of an area (square inches, square centimeters, etc.). Sometimes the measure is a relative figure, as for Izod impact strength; or a percentage relationship, as elongation. It is said by many engineers that all mechanical properties are relative because the units of pressure originated arbitrarily.

The mechanical properties listed in a data sheet are developed with standardized equipment, standardized methods, standardized procedures, and completely-controlled molding conditions and techniques. The molder often is vexed because his results do not come up to the properties as listed in the data sheet. Does this mean that the data sheet has no value? To answer this question, an examination of the two mechanical properties mentioned might prove of value.

Impact Strength

Some 15 different types of impact testing machines are used. The most common type employs the Izod method. A standard ½ x ½-inch specimen bar is supported vise-like at one end. A free-swinging pendulum is let fall so that it strikes the free end of the supported bar. The bar usually has a V-notch machined in at point of impact. Impact strength data are collected from notched bars both on the face side (across the top or bottom as oriented in the mold) and the side-side (across the sides). At times, an impact value is taken from notched impact specimen molded end-wise (usually transfer molded). Each result will be different. Likewise, one can expect impacts to vary in different sections of a molded piece, especially if the piece is quite large.

	Typical Impact Values*	
	A	B
Face-side (notched)	1.10	2.30
Side-Side (notched)	1.05	1.75
End molded (suggested)	.70	*

* Average impact, based on SPI mold. Range was very wide.

Impact strength is a relative measure of force spent in breaking a piece. It is an indication of resistance to break, or of shock resistance, or toughness under rapid stress. In the field, impact strength may increase when the material is used at slightly higher temperatures. At lower temperatures, some materials decrease in impact strength, while others show a gain.

Correlation of impact strength to design is a thesis in itself. Izod impact strength cannot be used for designing because it does not take into account all of the energies involved to break a piece, nor the sensitivity to breakage of differently-designed corners, radii, etc., at various impact-loading rates. However,

Izod impact strength values do allow the engineer to select higher or lower impact grades.

Tensile Strength

There are, perhaps, a dozen different types of testing machines that can be used or adapted to measure tensile strength of a plastic material. Essentially, tensile strength is measured by gripping (between jaws) both ends of a standard (dog-bone) test specimen tightly, and recording the pulling force required to rupture the piece completely. The tensile strength, as normally given in a data sheet, is the maximum breaking load per square inch of "original" cross-sectional area. The material supplier usually uses molded specimens (positive-type mold) for obtaining tensile strength results. However, specimens may be machined from slabs, or from the molded part in question. A.S.T.M. provides standard procedures for the universal comparison of data.

Tensile strength, as indicated in the data sheet, should be used for design purposes only if the part is to be subjected to exactly the same kind of stress and strain as in the standard test method. Stress relates to the intensity of the force, and strain relates to the elongation before complete rupture. The point at which deformation begins is called the "yield point." Elongation or deformation beyond the yield point varies with the type of material. A brittle material will have no measurable difference between the yield point and rupture. In thermosetting materials, this is especially true. The rate of strain—instantaneous, constant, gradual, over a period of time—can vary the stress-strain behavior. It should be noted that tensile strength, as given in a data sheet, cannot be considered significant for applications differing widely from the load-time scale of the standard test.

Other related data should be considered, in addition to the standard tensile strength of a data sheet, if absolute accuracy of structural design is necessary. Depending on how the part is used in the field, other data that may be considered are: modulus of elasticity (Young's modulus), yield strength; ultimate strength (correlated to the minimum cross-section); elongation; static strength (strength sustained after fracture); creep (a constant load is used with temperature and time as variables); cold flow (where deformation occurs, constantly, under load); and fatigue strength (long-time dynamic loads).

All in all, the tensile strength values in a data sheet can be used successfully for normal operations. Safety factors of about four to one are required to compensate for variations that may occur.

As you can see from the examination of the above two mechanical properties, there is no easy formula for solving a problem whether it be mechanical strength or the selection of a correct material for a job. Other mechanical properties such as flexural strength, compressive strength, shear strength, etc., as given in a data sheet are not absolutes. A data sheet is only a starting point, and its information must be translated in accordance with the intended use.

Finally, it must be remembered that molding conditions and molding techniques can greatly enhance, or destroy the intended mechanical properties of a molding compound.

Moldmaking & Tooling

(Cont'd. from page 47)

is required. If mold finishes are pre-determined and agreed upon by the parties concerned at the start of any project or individual mold contract, it will show results in many ways. For instance; better relationship, more accurate cost estimates, proper scheduling of work progress, proper selection of steels, and subsequent heat-treating of the steels for the best suitable hardness in Rockwell "C" scale. Also, it would minimize the down-time of the machine or press when the mold is returned for further improvement of its surfaces. In such cases, both parties suffer a loss—the molder in the production and the mold-maker in the re-scheduling of other molds or parts in order to bring the never-discussed finish to a certain micro-inch finish for satisfactory approval by the quality-control department and, therefore, the final acceptance of the mold.

I know that many mold contract shops have documented their own standard roughness-comparison specimens. However, as mentioned previously, they could differ greatly from the accepted A.S.M.E. Standard, the A.S.A. Standard, and the new Military Standards.

In view of the importance of this situation and the need for rectifying the error, the S.P.I. Moldmakers Division has started a program on mold finishes by the selection of five different roughness-comparison specimens to be introduced to the molding industry by the various sections or their individual divisions.

This certainly is very gratifying and a step in the right direction to minimize misunderstandings which plague this particular phase of the industry.

—The End

Errata

By some unexplainable happening, the compression and transfer presses made by Dake Corp., Grand Haven, Mich., were omitted from the Comparative Data tabulation that was featured in the February issue, pages 50-55. Six machine models in the company's Series 27 line of compression presses should have been shown, ranging from 50-500 tons in capacity. These standard models are semi-automatic units, although manual or automatic machines can be furnished. These standard models feature guided-platen operation, variable pressing speeds, selective hydraulic ejection, and adherence to J.I.C. electrical standards. Optional features are that speed, stroke, platen size, and controls can be modified to suit requirements. In addition, Series 43 transfer presses are available from Dake Corp.

Equally unexplainable is the error made on American Steel Foundries presses that were listed under the name of that company's King Machine Tool Division, instead of the Elmes Engineering Division which is the manufacturing facility.

NEWS of the Industry

erratum

In December, we reported that Carbic-Hoechst Corp., Hostachem Corp., and Hostawax Co. had moved to a new plant in Mountainside, N. J. Actually, the plant is still under construction and the move will not take place until late spring or early summer. Sorry.

agents, distributors & agreements

Auto-Blow Corp. has negotiated a license agreement with the English firm, E. Shipton & Co., Ltd., allowing it to incorporate any design features covered by Shipton patents for multiple-station machines and the process of blowing through a manifold. The agreement also covers a patent application for a new die opening and closing mechanism.

Catalin Corp. of America has signed an agreement with Dow Chemical Co. covering the synthesis and testing of new chemicals.

Chicago Molded Products Corp. has named Plastic Sales & Mfg. Co., Kansas City, Mo., its distributor for Campco sheet and film in that area.

G. T. Schjeldahl Co., Northfield, Minn., has licensed C. A. Harnden, Ltd., of London, England, to manufacture its line of side-weld polyethylene bag-making machines.

J. M. Huber Corp. has named O'Connor Chemicals, Inc., its exclusive distributor of kaolin clays and silicate pigments in the Detroit and Toledo areas.

Marblette Corp. has appointed International Sales Corp., Seattle, Wash., its distributor in the Northwest, and Ram Chemicals, Inc., in the states of Arizona and California. The Marblette line includes phenolic resins, epoxies, and rigid urethane foam.

Plastics Color Co. has appointed Hastings Plastics as its West Coast distributor. The New Jersey firm manufactures both epoxy and polyester paste concentrates.

Prodex Corp. has licensed Henschel-Werke of Kassel, Germany to manufacture its line of extruders.

Thoreson-McCosh, Inc., has appointed Oak Engineering Co., Inc., Gloucester City, N. J., its agent in Delaware, Maryland, District of Columbia, eastern Pennsylvania, upper Virginia, and southern New Jersey. The Thoreson-McCosh line includes hopper-dryers, hopper-loaders, and shear-way grinder units. A Minneapolis firm, Chas. W. Stone Co., was named exclusive distributor in western Wisconsin, Minnesota, N. Dakota, and S. Dakota.

Rainville Co., Garden City, N.Y., has completed a patent licensing agreement with Owens-Illinois Glass Co. authorizing the former to grant purchasers of plastic blowing machines fully-paid sub-licenses under the latter's patents. Machines sold by Rainville include the Blow-O-Matic, the S.C.A.E., and the Eisler Rotary Table.

Stewart Bolling & Co., Inc., has chosen as its New England distributor, Clarke Associates, of Wayland, Mass. The Stewart Bolling line includes mills, mixers, calenders, hydraulic presses, and extruders.

Texstar Corp., San Antonio, Tex., and Air Accessories, Inc., Fort Worth, have merged, and the latter firm will be known as the Texstar Plastics division. Its branch factory in Fort Wayne, Ind., will continue under the direction of the new division.

business developments

Allied Chemical Corp. has doubled its facilities in Toledo for the manufacture of melamine and urea molding compounds. Full-scale production (90-million pounds) will probably not be reached until the late 1960's, except for short seasonal demands.

Atlantic Research Corp., Alexandria, Va., has developed a series of one-shot urethane foams called ArcMold. Available densities vary from one to 40 pounds per cubic foot.

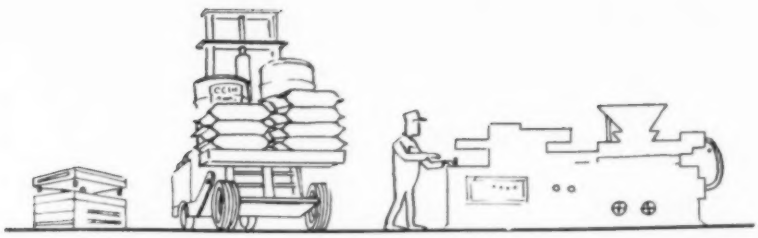
Burgess Pigment Co., Sandersville, Ga., has installed a new Nichols Herreshoff Calcining furnace which will more than double the firm's capacity for turning out hydrous and anhydrous aluminum silicate pigments and kaolin clays.

Hercules Powder Co. has been negotiating the acquisition of Imperial Color Chemical & Paper Corp., of Glen Falls, N. Y. Pending approval by both boards of directors, the move should broaden the diversification plans of both firms.

National Cleveland Corp. has formed a plastics chemical division, with offices in Bridgeport, Conn. The division plans to market inks, paints, lacquers, and coatings for polyethylene and polypropylene.

Permagile Corp. of America has expanded its line of epoxy materials to include a cement weld, a skid-proof protective coating, a water-proof coating, and a concrete sealer.

Polymer Corp. has formed two new divisions—Whirlclad and Molding Resins. The first will assume all activities of National Polymer Products, Inc., now discontinued as an active subsidiary, with respect to Whirlclad coating, the latter all activities related to Nylatron.



Allied Chemical Corp. plans to triple production of its Golden Caprolan nylon-6 yarn for auto tires.

Oronite Chemical Co., San Francisco, Calif., has created a surface coatings & plastics chemicals division. This division will not only handle Isophthalic, but also promote phenol, acetone, and phthalic anhydride.

Rexall Drug & Chemical Co. has created a chemical division with Ralph M. Knight as president and John R. Provo as vice president.

Richardson Co. completed its second major expansion within a month with the purchase of Treplow Products, Inc., Paterson, N. J., which it will operate as a subsidiary, Treplow Chemical Co. Treplow products include organic chemicals and synthetic resins.

Sun Rubber Co., Barberton, O., has obtained $2,750,000 new capital and expects to resume full-scale operations. The money was provided by the Cleveland investment house of McDonald & Co., in conjunction with McNeil Machine & Engineering Co. of Akron.

Standard Cap & Molding Co. has entered the injection molding field in the Midwest, with a new plant in Hillside, Ill. Chester Kotecki will supervise the operation.

Taylor Fibre Co., Norristown, Pa., has formed a separate molded parts department to meet increased demands for high-pressure laminates.

Union Carbide Plastics Co. has increased its capacity for producing polyvinyl ethyl ether resins at South Charleston, W. Va.

Winner Mfg. Co., Inc., West Trenton, N. J., has expanded its custom molding division in the field of fiberglass-reinforced plastics. Plans call for increased activity in the product design area, with special emphasis on research and development in laminating.

general/specific interest

Brunswick-Balke-Collender Co. won the grand prize for new reinforced plastic products at the 15th annual conference of SPI's Reinforced Plastics Division. Some 350 items were entered.

Hysol Corp. is the new name for Houghton Laboratories of Olean, N. Y. Company policy remains unchanged.

SPE's Vinyl PAG (professional activities group) elected Saul Gobstein of Ferro Chemical Co., its chairman for 1960. Vice chairmen are Joseph Clancy, Emery Industries, and Irvin Podell of Podell, Inc. W. Waychoff of Monsanto Chemical Co. was elected secretary.

new companies & ownership changes

Borden Co. has acquired the business of Commercial Ink & Lacquer Co., Fair Lawn, N. J., and Whitehouse, O., and will operate it as the Ink & Lacquer department of Borden. No major policy changes are planned.

Dimensional Pigments, Inc., a new Bayonne, N. J., firm, will be producing synthetic nacreous pigments for the plastics, coatings, ink, and cosmetic fields. The company has a research laboratory with facilities for basic research as well as customer service. Physical facilities encompass 11,000 square feet of factory space, including a four-story tower for basic chemical operations. Company officers are: William C. Stout, president; George Meyers, vice president; and Louis Kogan, secretary-treasurer.

KDK Plastics Co. is a new firm with plant and laboratory facilities in Harpursville, N. Y., founded by Jerome D. Bassin, former epoxy group leader at Borden Chemical. KDK will do custom formulating of epoxies, polyesters, and phenolics; custom mold fiberglass-reinforced plastics; and act as a consulting and engineering service in those fields.

Modern Plastic Machinery Corp. has acquired Boston Plastic Machinery, Inc., a manufacturer of blow molding equipment. The latter firm will be physically integrated into the Clifton plant and will operate as its blow molding division.

Polyethylene Corp. of America is a newly-organized film extruder in Cranbury, N. J., with Robert N. Green as president and Paul N. Colby as vice president and sales manager. The firm plans to specialize in polyethylene sheeting for the flexible packaging industry, and currently has facilities for making blown film up to 14 feet wide and sheet up to 75 inches.

Reichhold Chemicals' board of directors has approved the acquisition of Alsynite Co. of America for an undisclosed number of shares of Reichhold common stock, subject to approval by Alsynite stockholders. Included in the assets are Alsynite Co. of California, Alsynite Co. of New Jersey, Everlite Corp., Plastikool Awning Corp., Ray-O-Lite Corp. of America, and Chemiglas, Inc.

Names in the News

Frank E. Seborowsky

Frank E. Seborowsky has been appointed general manager of Chanal Plastics Corp.'s new blow molding division. Mr. Seborowsky will be responsible for custom molding for the industrial parts, packaging, bottle, display, and toy industries.

David W. Quinn has been appointed manager of the Grace plant of Vulcan Rubber Products Division, Reeves Brothers, Inc. Mr. Quinn comes to the Rutherfordton, N.C., plant from Empire Division, Hettrick Manufacturing Co., where he was vice president in charge of coated fabrics.

Harvey Bowman has been named plant engineer for Norton Laboratories, Inc. Coming from Auburn Plastics, Inc., he will assume responsibilities for planning and purchasing new equipment and supplies plus building and equipment maintenance.

Richard E. Wade has been named Western regional manager for Ren Plastics, Inc., Lansing, Mich., formulator of epoxy resins. His headquarters will be in Gardena, Calif.

Richard Koshinski has been appointed manager of sales service and sales representative, Western New York, for Norton Laboratories, Inc., and its sister company, Auburn Plastics, Inc. He was previously associated with Grigoleit Co. and General Electric.

W. C. Franklin has been appointed manager of the newly-organized polychemicals department, Texas Butadiene & Chemical Corp. He joined the firm as manager of market development, and had been serving as assistant sales manager.

Saul Skoler has been named general manager of Plastics Industrial Products, Inc., Peabody, Mass., custom extruder. Mr. Skoler was formerly associated with Kordite Corp. and W. R. Grace & Co.

Robert E. Pierson has been appointed commodity manager, transportation products department, for U. S. Rubber's footwear and general products division. He has held various engineering and sales positions since joining the firm in 1948.

Rodney H. Morrison has been appointed sales engineer for Davis-Standard, division of Franklin Research Corp. He will cover most of the Eastern seaboard.

William A. Gallup has been appointed senior research chemist for Diamond Alkali's plastics division. He previously served with Aerojet-General Corp., and with Sun Oil Co.

Bruce Ainsworth

Bruce Ainsworth has been elected president of Harchem division, Wallace & Tiernan, Inc. Formerly a vice presidential assistant, Mr. Ainsworth also worked with Celanese Corp. of America.

Robert H. Olson has been appointed superintendent of Allied Chemical Corp.'s molding compound plant at Toledo, O. Mr. Olson previously served as supervisor of soda ash operations at the Solvay process plant in Syracuse, N. Y.

Charles E. Rank has been elected executive vice president of Harry Davies Molding Co. He will continue in his capacity as general manager of the corporation.

Hungerford Plastics Corp. has announced the following executive promotions:

Jack Sandler, from vice president in charge of the injection molding department to senior vice president; **Arne Osth,** from vice president in charge of production to vice president in charge of engineering; **Ake V. Ljung,** from production manager of the rotary division to vice president in charge of production; and **Donald P. Arrowsmith,** from sales manager of consumer products to vice president in charge of sales.

Harry A. Batley

George G. Stier

George G. Stier has been elected president of Nopco Chemical Co. Mr. Stier, who has been with Nopco since 1932, was previously vice president in charge of the plastics division in North Arlington, N. J. **Ralph Wechsler,** former president, was elected chairman of the board, succeeding **Thomas A. Primton**, who will continue as a director and member of the executive committee. **Harry A. Batley,** vice president in charge of industrial production, was elected vice president. He replaces **G. Daniel Davis,** the new vice chairman of the board.

Plax Corp. has announced five promotions in its marketing and research & development departments. **Richard J. Morcom,** formerly an assistant research manager, has been appointed manager, technical service, film and sheet sales division. **Lawrence D. Barr** and **Merlin L. Evans** have been named section supervisors in the research and development department. Both had been development engineers with the company since 1957. **John Carlile,** manager, sales administration, has been made responsible for the product management of the folding tray and box marketing program. **Roger J. Chamberland** has assumed Mr. Carlile's previous responsibilities.

William J. Monohan has been named vice president in charge of sales for Seamco Chemical Co.

John F. O'Donnell

John F. O'Donnell has been appointed director of commercial development at Kordite Corp. Dr. O'Donnell, who will supervise applications research, semi-commercial manufacturing operations, technical service, and plant design and construction, joined Kordite last year after service with DuPont Co.

SPI's Epoxy Resin Formulators Division has re-elected the following officers to serve for another year: chairman, **L. R. Miller,** Rezolin, Inc.; first vice chairman, **John Delmonte,** Furane Plastics, Inc.; and second vice chairman, **Donald Roon,** Houghton Laboratories, Inc.

Names in the News (Cont'd.)

J. A. Quinn has been named vice president of Wymat Chemical Corp. He most recently served as sales manager for the detergent and chemical specialties division of Theobald Industries, Wymat's parent company.

Harvey Bowman has been named plant engineer for Norton Laboratories, Inc. Coming from Auburn Plastics, Inc., he will assume responsibilities for planning and purchasing new equipment and supplies plus building and equipment maintenance.

Robert W. Shull has been named merchandising manager of Lenox Plastics, Inc. For the past three years, he has served as advertising and promotion manager at A. G. Spalding & Bros.

Sumner E. Tinkham

Sumner E. Tinkham has been appointed vice president-engineering at Tech Art Plastics Co. He most recently served as executive engineer for Boonton Molding Co.

Wayne W. Camp has been appointed technical representative in the midwest and east by Ren Plastics, Inc. Mr. Camp, whose headquarters is in Toledo, O., will cover Ohio, Kentucky, Western New York, Western Pennsylvania, Western West Virginia, and Southern Indiana.

George W. Walpert has been named senior research engineer for Kordite Corp. Dr. Walpert, who will be responsible for applied research in the areas of new polymer films, previously was associated with Wigton Development Laboratory, the atomic energy division of Phillips Petroleum Co., and Monsanto Chemical Co.

Russell R. Menard has been named manager of profit planing at Haveg Industries, Inc.'s Taunton division.

E. M. Davis has been promoted to vice president of Injection Molding Co., subsidiary of Rexall Drug and Chemical Co. Formerly director of purchasing at the Kansas City headquarters of Imco, Mr. Davis will be concerned with production at U.S. and Canada subsidiary plants. **Frederick L. Kocher,** district sales manager in Chicago, has been named general sales manager. He will also be located at Kansas City.

Donald M. Hatch, Jr.

Donald M. Hatch, Jr., has been elected a vice president of Dumont Manufacturing Corp. and its parent firm, Dutron Corp. Among other administrative duties, Mr. Hatch will be a general manager in charge of sales, production, and research work on Dumont's line of reinforced plastic products.

Paul V. Osborn, Jr., has been named manager of mechanical engineering for Kordite Co. Mr. Osborn, who has been with the company as a senior project engineer, will supervise all mechanical development projects.

Ernest D. Carmagnola, design consultant and co-founder of Cecil S. Volk Associates, has been appointed chief engineer for Jamison Plastics Corp. Mr. Carmagnola is responsible for all engineering functions, including new product development and engineering, and tooling new injection molded items.

Val Reisig has been named assistant advertising manager, plastics division, Eastman Chemical Products, Inc. Mr. Reisig, who joined Eastman in 1958, will continue to serve under the advertising manager at the firm's New York office.

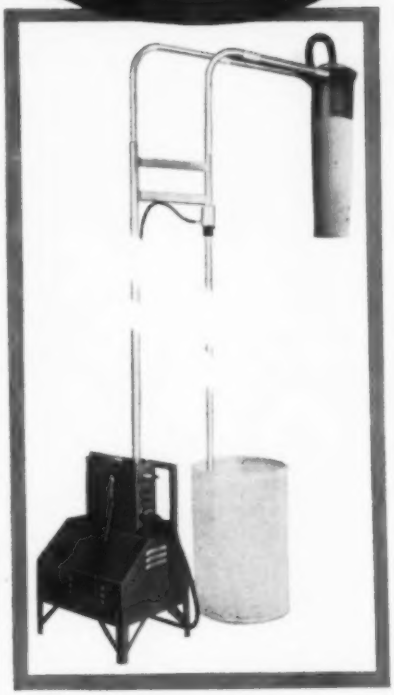
Joseph J. Barrese has been appointed sales manager for Mannesmann-Easton Plastic Products Co., Inc. He has been with the organization for two years as a salesman.

Robert Shevett

Robert Shevett has been selected technical sales director at Rainville Co., where he has been employed for 3½ years as sales engineer. He will be responsible for liaison between sales and manufacturing.

Earl A. Erich has been elected vice president of Tube Turns Plastics, Inc. Since joining the technical service staff of Tube Turns in 1955, he has been promoted, successively, to assistant sales manager and sales manager.

New
VACUUM CONVEYOR PUTS
ALL THE POWDER IN YOUR HOPPER!



Engineered for dust-free efficiency, the new Whitlock Model 400 Vacuum Conveyor moves over 1,200 lbs. of free-flowing powdered or granular material per hour—*automatically.*

Self-supporting, with power and control unit on floor, away from press if desired, vacuum hopper is placed over machine hopper, not on it.

Designed for easy cleaning, the Model 400 features an automatic blow-back for cleaning the filter after each loading cycle; plus a telescoping pick-up tube for fast drum changing.

For complete information on the new Whitlock Vacuum Conveyor write:

Whitlock
60-C

WHITLOCK ASSOCIATES INC.
21655 Coolidge Hwy. Oak Park 37, Mich.

New Materials

Write item numbers on Readers' Service Card (p. 77) to obtain more information.

Semi-Rigid Epoxy System

Resin Formulators, Inc. has developed ResinKast 709, a semi-rigid epoxy resin system featuring long pot life and low mix viscosity. Rated as class B electrical insulation material, the resin is claimed to have excellent thermal and mechanical shock resistance. Shrinkage is minimal, with little exothermic reaction.

Because of its long pot life (2 to 4-day working life for 5-gallon mass at 75° F.) and low mix viscosity (4200 cps. at 25° C.) it makes a good impregnating resin, useful for large or small castings.

Cure schedule is 16 hours at 175° F., or 8 hours at 200° F. Two-stage cure for castings over 100 pounds is 15 hours at 150° F., plus 16 hours at 175° F. Maximum use temperature is 350° F. Electrical properties are:

Dielectric strength, volts/mil.	450
Dielectric constant, 100 Kc.	3.35
Dissipation factor, 100 Kc.	0.028
Volume resistivity, 100° F., ohm/cm	1.2×10^{14}

Readers' Service Item 1

Thermosetting Acrylic Coatings

Rohm & Haas Co. has announced the production of two thermosetting acrylic resins for coatings. Acryloid AT-50 and Rhoplex AC-200, respectively a solution polymer and an emulsion polymer, are baking enamel components suggested for formulation into metal coatings and finishes for appliances, metal furniture, hospital equipment, stoves, drum, and in metal decorating.

Typical physical properties of suggested formulations of the polymer are below. Formulation 181-B is a white enamel based on Rhoplex AC-200, while 183 is an epoxy-modified enamel using Acryloid AT-50. Both films were baked at 300° F. for 30 minutes.

	181-B	183
Tukon (Knoop) hardness	14.5	27.2
Gloss, 60°, photovolt	80	93
Microknife adhesion	3.7	30.6
Impact resistance, in. lbs.	50	—

Readers' Service Item 2

Thermoplastic Stabilizer

Voidox 100%, introduced as a food-grade antioxidant, has been found to modify the flexibility and light resistance of common polyolefins and polyvinyls. Manufactured by Guardian Chemical Corp., Voidox 100% is a white, waxy, fatty-acid modified derivative of a substituted phenol. Because of its low toxicity and its acceptability for use in many types of foods, Voidox 100% is suggested for incorporation in food containers.

Substantially free from any characteristic odor, the material comes in flakes of varying size and thickness. Specifications include:

Specific gravity, 60° C.	0.9-0.95
Approximate bulk density, lbs./ft.^{3}	4-4.5
pH, 1% dispersion	6.5-7.2
Melting point, °C.	53-57
Moisture content, max., %	1.5
Free organic acid (oleic), max., %	1.25
Inorganic matter, max., %	1.5
Chlorides, max., %	1
Heavy metals, max. %	0.4
Volatile solvents, max., %	9.2

Readers' Service Item 3

Polyethylene Packaging Film

U. S. Industrial Chemicals Co.'s Petrothene 207-62 is designed to have the optimum anti-block and balanced slip properties for use in garment bags. Average properties of this odorless film are:

Melt index, g./10 min.	7.98
Draw down, 460° F., fpm.	451
Color	<1
Density	0.9230
Film transparency, %, M. D.	85
T. D.	91
Film haze, %	6.8
Gloss	9.90
Torsional stiffness, psi.	47,800
Modulus of elasticity, psi.	19,000
Yield point, 20 in./min., psi.	1,770
Tensile, ultimate, 20 in./min., psi.	1,390
Elongation, 20 in./min., %	270
Stress crack resistance, 50°F., hrs.	<0.3
Sandbag impact of film, ft.	2.5
Dart drop impact of film, ft.	94

Readers' Service Item 4

Water Soluble PVA Film

For packaging applications in which the water solubility of the package is of primary consideration or desirable, Reynolds Metals Co. has developed a water soluble polyvinyl alcohol film. In water at 80° F., a 2½ by 4 inch pillow pack will disintegrate in 20 seconds, and dissolve with no residue in 40 seconds.

The film is reported to have excellent heat sealing characteristics. On packaging machinery, sealing jar temperatures range from 275-330° F., depending on packaging speeds and humidity. Teflon-impregnated fiberglass or Teflon tape is usually recommended to prevent blocking.

The film is impervious to most common gases, with the exception of water vapor and ammonia. It is impervious to most oils, greases, organic solvents, and hydrocarbons. Packages will contain, without adverse effect, items such as detergents, bleaches, insecticides, dyes, and salts. Exceptions are those which release free chlorine, are hydroscopic, or contain measurable quantities of water.

While the film is non-toxic, it is not meant for internal consumption. It is colorless, translucent, and has a slightly acetic odor. One side is smooth, the other matte. It will burn slowly. Other characteristics are:

Modulus, psi.	>1,000
Tear strength, gpm.	>200
Tensile strength, psi.	>2,000
Elongation, %	>250
Aging Atlas-Fade-ometer, hrs.	>500
Sealing	
Thermal, ½ sec., 20 psi., ° F.	275
Electronic	7½ temp., 7½ heat

Readers' Service Item 5

Glass-Epoxy Laminates

Taylor Fibre Co. has announced a glass-base, epoxy laminate for normal and high temperature applications. Designated GEC-111, a ⅛-sheet of the material is reported to retain 68% of its flexural strength after one hour at 300° F. Maximum heat for continuous use is 350° F. Printed circuit boards from GEC-111 copper-clad laminates will not distort in solder baths.

GEC-111 is furnished in sheets 0.01 to 1 inch thick. Sheets up to $\frac{3}{32}$-inch may be cold punched. The copper-clad laminate is supplied with rolled copper foil (GEC-111R) or with electrolytically deposited foil (GEC-111E). The bond strength of copper foil is from 8 to 10 pounds per inch of foil width, depending upon the type and thickness of foil.

Typical properties of a $\frac{1}{16}$-inch thick sheet of Taylor's glass-epoxy laminate include:

Water absorption, 24 hrs. immersion, %, max.	0.2
Specific gravity	1.8
Flexural strength, psi., min., lengthwise	60,000
Crosswise	50,000
Tensile strength, psi., min., lengthwise	45,000
Crosswise	40,000
Dielectric strength, kv., min.	45.0
Dissipation factor, 60 cycle	0.006
1 mc.	0.020-0.030
Insulation resistance, megohms	350,000

Readers' Service Item 6

FEDERAL PACIFIC PRAISES EXCELLENT ELECTRICAL PROPERTIES OF RCI PLYOPHEN 5660

More than 50,000 circuit breakers, as well as a wide array of other electrical devices, are produced every day by Federal Pacific Electric Company's Distributor Products Division plants in Newark, New Jersey. "Each of these circuit breakers has an average of three parts molded from phenolic resin compounds," states R. B. Goody, in charge of plastics research. "This makes it imperative that the resin used meet strict performance criteria. RCI PLYOPHEN 5660 exceeds these requirements in our production."

Here are some of the resin characteristics that FPE seeks and PLYOPHEN 5660 provides:

- Electrical properties that resist voltage breakdown in accordance with the rigid safety codes of the Underwriters' Laboratories.
- Ability to withstand severe physical shocks.
- Minimum warpage and moisture absorption under extreme temperature and humidity conditions.
- Good mechanical stability.

"RCI PLYOPHEN 5660 (phenol-formaldehyde resin) passes all these tests. Molded part rejections due to material failure are less than one-tenth of one percent," says Mr. Goody.

If *your* production calls for phenolics, remember that RCI offers over 40 individual types of PLYOPHEN, both liquids and powders, for bonding, laminating, impregnating or casting applications. Moreover, every RCI customer gets the benefit of expert technical assistance whenever required. Write today for complete information (state specific application).

Synthetic Resins • Chemical Colors • Industrial Adhesives • Phenol
Hydrochloric Acid • Formaldehyde • Glycerine • Phthalic Anhydride
Maleic Anhydride • Sebacic Acid • Ortho-Phenylphenol • Sodium Sulfite
Pentaerythritol • Pentachlorophenol • Sodium Pentachlorophenate
Sulfuric Acid • Methanol

Creative Chemistry . . . Your Partner in Progress

REICHHOLD RCI

REICHHOLD CHEMICALS, INC.,
RCI BUILDING, WHITE PLAINS, N.Y.

Styrene-Coating Spray

Schwartz Chemical Co. has developed a coating formulation to color products molded, vacuum formed, or fabricated from sheets of modified styrene materials, ABS plastics, and acrylics. Designated Rez-N-Lac C, the fast-drying lacquer produces a smooth, hard, high-gloss finish which reportedly withstands Scotch Tape and crosshatch scratch tests. Applications include radio and television cabinets, automotive trim, and decorative components for household appliances.

Readers' Service Item 7

Primary Plasticizer

Di-(2-ethylhexyl) isophthalate (DOIP) has been added to the list of plasticizers available from Eastman Chemical Products, Inc. Useful for compounding and plastisol formulations, it is compatible with PVC, cellulose nitrate, ethylcellulose, polystyrene, and cellulose acetate butyrates of high butyryl content.

Film comparisons with DOP-plasticized materials show close agreement in most physical properties. However, DOIP lowers volatility loss on heat aging and increases resistance to water extraction. In plastisol formulations with PVC, DOIP gives not only lower viscosity, but viscosity stability during aging at room temperature. Some average properties of DOIP are:

Color, APHA, ppm.	20
Acidity (isophthalic), %	0.003
Ester content, $	99.4
Ash	0
Boiling point, 760 mm., °C.	358

Readers' Service Item 8

One-Shot System Lubricant

Formula-OSR was developed as a release agent for one-shot polyurethane foams. This neutral solvent dispersion of waxes and resins is available from Clover Chemicals, and is merely sprayed or brushed on and allowed to dry before the foam is poured. Cured foam may be stripped immediately or after cooling the mold.

This odorless, off-white gel may be used on metal, epoxy, or wood molds. It has a solids content of 15%. The approximate melting point is 190° F.

Readers' Service Item 9

Air-Drying Coating Resin

Archer-Daniels-Midland's Aroplaz 6006 is claimed to set tack free in about five minutes and harden into a tough, glossy finish without baking. An oil-modified alkyd, the resin was developed for finishing metal industrial and consumer items. The resin will tape dry in about an hour, and can be recoated.

Aroplaz 6006 is furnished at 50% solids in xylol having a viscosity range of W-Y and can be cut back with aliphatic as well as aromatic solvents.

Readers' Service Item 10

Polyethylene Flame Retardant

According to Monsanto Chemical Co., the commercially available flame retardant for polyethylene trademarked Aroclor 5460 gives greater heat stability and offers fabricators better processing qualities than comparative materials. This 60% chlorinated terphenyl reportedly aids the economy of faster processing by improving the melt flow of the polyethylene.

Polyethylenes modified with Aroclor 5460, when compared with those containing other flame retardants, are reported to show greater resistance to heat discoloration during injection molding and extrusion operations, and to retain their tensile properties.

Properties of 70% polyethylene, 30% Aroclor 5460 material are:

Melt index	11.2
Memory, %	51.5
Tensile strength, psi	1850
Elongation, %	647
Yield, psi	1320

Readers' Service Item 11

When the problem is inorganic pigments and extenders for compounding plastics...

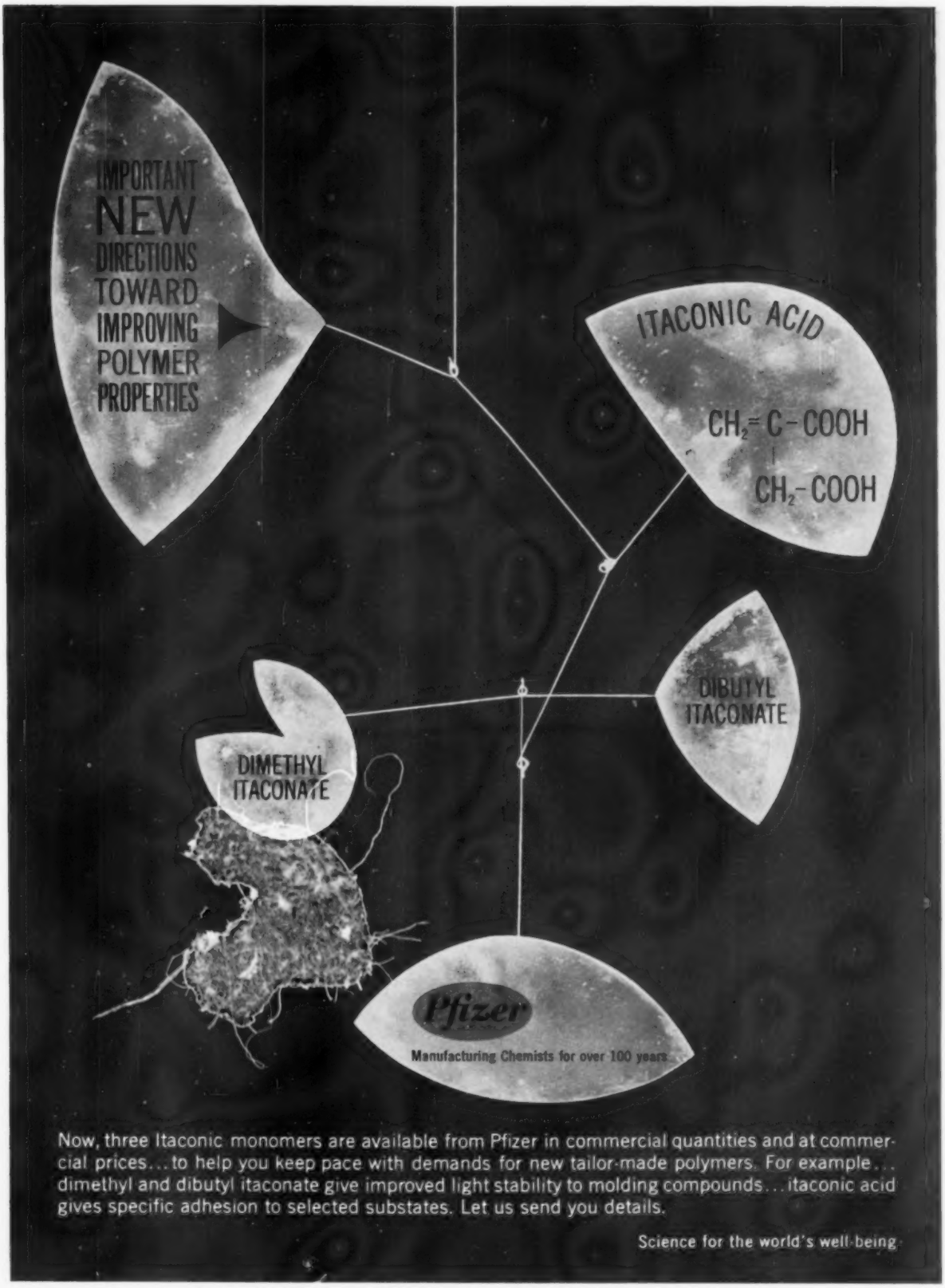
WILLIAMS *invites you to take advantage of its* **80 YEARS EXPERIENCE**

Today Williams offers a complete line of inorganic pigments and extenders for the plastics industry. All have color permanence and chemical stability. Here is a representative list of these products.

Pure Red Iron Oxides** • **Pure Yellow Iron Oxides** • **Pure Black Iron Oxides** • **Pure Brown Iron Oxides** • **Pure Chromium Oxide Greens** • **Pure Hydrated Chromium Oxides** • **Umbers** • **Siennas** • **Lampblack** • **Anhydrous Calcium Sulfate** • **Barytes** • **Calcium Carbonates

Send today for detailed Technical Reports which give you complete description of the chemical and physical properties of each. Address Department 37, C. K. Williams & Co., 640 N. 13th Street, Easton, Pennsylvania.

WILLIAMS
COLORS & PIGMENTS C. K. WILLIAMS & CO.
E. St. Louis, Illinois • Easton, Pennsylvania • Emeryville, California



Now, three Itaconic monomers are available from Pfizer in commercial quantities and at commercial prices... to help you keep pace with demands for new tailor-made polymers. For example... dimethyl and dibutyl itaconate give improved light stability to molding compounds... itaconic acid gives specific adhesion to selected substates. Let us send you details.

Science for the world's well-being

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GENERAL COLOR COMPANY

Manufacturers of Cadmium Yellows and Reds

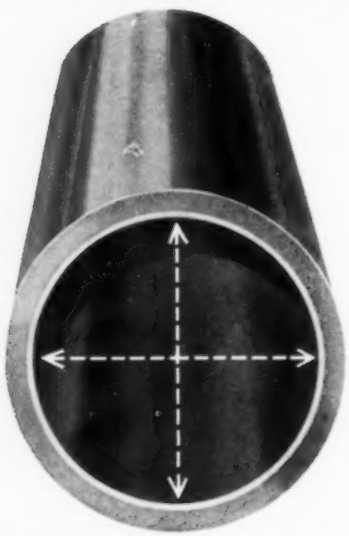
FOR THE ASKING

Catalog showing 50 standard shades and suggested usage.

The aid of our research department on your special pigment problems is available. Just give us the pertinent details.

GENERAL COLOR COMPANY
Division of H. Kohnstamm & Co., Inc.
24 AVENUE B, NEWARK 5, N. J.

Extruder cylinders to customer specifications



Only Xaloy bimetallic cylinders are available in any length, diameter and wall thickness—for newly-designed equipment and for replacement in existing extruders. Extensive design, engineering and production facilities are available to review your individual requirements. *Xaloy...original equipment on all leading extruders—and the logical replacement for every extruder.* Write for new Xaloy Engineering Data Guide.

INDUSTRIAL RESEARCH LABORATORIES
Division of Honolulu Oil Corp.
961 East Slauson Ave.
Los Angeles, Calif.

New Equipment

Write item numbers on Readers' Service Card (p. 77) to obtain more information.

Keithley portable static meter.

Battery-Operated Static Meter

For measuring static charges on plastics and other poor conductors, Keithley Instruments, Inc., is offering Model 250 electrometer voltmeter. The 250 detects static charges by electrostatic induction, indicating their voltages on a panel meter. The meter has a range of 10 kilovolts and 30 kilovolts when the detecting head is ⅜ inch from the charged surface, and up to 100 kilovolts at a distance of six inches. Accuracy is within 5%. The system is polarity sensitive, indicating both negative and positive charges.

Included with the detecting head is a connecting cable, ground wire, and carrying case, 1½ by 10⅜ by 5⅞ inches.

Readers' Service Item 21

Pressure Transducer

Because fluctuations in melt temperature and pressure at the die affect extrusions, Dynamic Instrument Co., Inc., has designed Dynisco Model PT58 pressure transducer for use in thermoplastic extrusion process instrumentation. By sensing pressure fluctuations in the melt and thereby initiating corrective information, the transducer maintains constant flow.

The unit has repeatability of 0.1% and maximum diaphragm operating temperature of 750° F. Units are available for complete pressure range of 0-1,000 to 0-10,000 psi.

PT58 transducers are supplied with a water cooling jacket to protect the strain gage sensing element. The cooled portion of the transducer is sufficiently far from the diaphragm to insure the melt will not solidify on the pressure sensing surface.

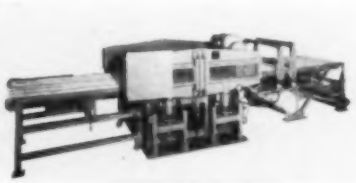
The transducer is available in two stem lengths, 6¼ and 7¾ inches, and mounts in a standard ½-20 NF threaded fitting.

Dynisco Model PT58 pressure transducer.

Readers' Service Item 22

Small Roller Die Cutter

Falls Engineering & Machine Co. is manufacturing a smaller size unit of its automatic roller die cutter. Known as model 11103, the cutter has a pinch bar feed which will accommodate a roll of material 40 inches wide. Die cutter bed is 39 inches long. The feeding mechanism stroke can be regulated anywhere from six to 39 inches.



Femco Model 11103.

The unit is equipped with a roll feed mechanism and discharge conveyor which carries die cut pieces to an accessible unload position.

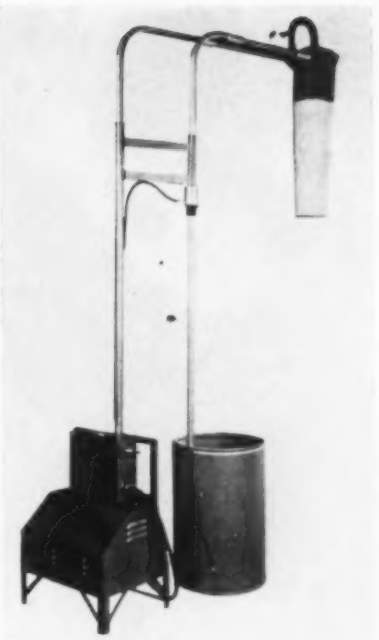
Readers' Service Item 23

Dust-Free Material Handler

The Whitlock Associates, Inc., eductor-type vacuum conveyor is reported to move over 1,200 pounds of free-flowing powdered or granular material an hour. A sealed auxiliary hopper suspended over the press hopper traps the material in a vacuum, which is automatically released when the auxiliary is filled. The material then flows through a soft shroud into the presser hopper.

Model 400 has its power and control unit placed on the floor. To clean the filter of dust, air is forced back through it after each loading cycle. A telescoping pick-up tube is provided to speed drum placement and changing.

The conveyor is supplied for 220/60/1, 220/60/3, or 440/60/3 operation.



Whitlock Vacuum Conveyor

Readers' Service Item 24

Cold-Folding Packager

An automatic machine to form plastic sheet into packages without the application of heat or adhesives has been announced by R. A. Jones & Co., Inc. The machine cold-folds and locks unscored die-cut plastic blanks into trays at speeds of 40 to 100 per minute, depending on package size and dimensions.

Plasti-Lok packaging system.

Designated Plasti-Lok, the development is a cooperative venture by Monsanto Chemical Co., Charles E. Palmer & Associates, and Jones, using Polyflex oriented styrene sheet manufactured by Plax Corp. Basis of the system, cold-folding, was developed by Palmer. Essentially, it is a means of confining the material to prevent cracking or crazing while it is being folded, and subsequently permitting it to resume

"...we always use the highest quality plasticizers available"

Harold Nelson, Technical Director of Coated Fabrics Division of the United States Rubber Company, says:

"A technical director has two main responsibilities: maintain product quality and keep costs to a minimum. Considering plasticizers, we feel that they play a most important part in the quality of our Naugahyde vinyl upholstery. And, that is why we first look for quality in plasticizers and secondly for price.

"Naturally, price must be consistent with end use requirements, but we always try to enhance the reputation of our products by providing just a little extra in performance. And, cutting corners on the price of plasticizers can lead to processing difficulties and higher scrap—and above all, quality problems. These problems result in higher costs in the long run and damaging blows to a company's reputation. So, that is why we always use the highest quality plasticizers available."

Where the accent's on quality
there's a preference for ***Plastolein® Plasticizers***

Emery

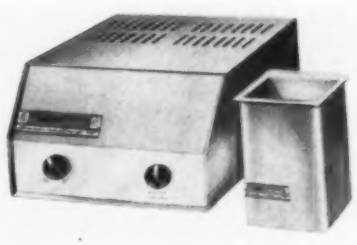
Organic Chemical Sales Department
EMERY INDUSTRIES, INC., CAREW TOWER, CINCINNATI 2, O.
Vopcolene Div., Los Angeles—Emery Industries (Canada), London, Ontario
Export Department, Cincinnati

its stability after the package is locked.

Especially recommended for applications in which the clarity and rigidity of the package provides high merchandising advantages, the system is claimed to make possible, for the first time, low-cost packages with complete product visibility.

Several models of the packager are available.

Readers' Service Item 25



Disintegrator System Forty.

Ultrasonic Cleaner

The Disintegrator System Forty is reported to remove more than 50 kinds of dirt and contaminants from products ranging from surgical instruments and false teeth to highly complex electronic components. Operating on a 40 watt generator, 10 by 8 by 5-3/4 inches, with an output of 90,000 cycles per second, Ultrasonic Industries' cleaner is designed to consume no more current than a light bulb.

The generator powers a half-gallon capacity cleaning tank with a working compartment 5-3/4 by 5-1/4 by 5 inches. Overall dimensions of the stainless steel tank are 6-3/4 by 6-1/4 by 6-1/2 inches. It is finished with a 4A grade high polish to prevent contamination.

Merely adding solvent or water and detergent, and flipping a switch, is sufficient to initiate cleaning. The unit is particularly useful for cleaning small, hard-to-reach crevices.

Readers' Service Item 26

Automatic Rapid Spray Coater

Conforming Matrix Corp. has announced a machine for applying coatings to small articles such as electrical and electronic components having coaxial leads. The remote masking spray coater will coat, for example, selenium diodes with a resinous composition such as an epoxy compound at a rate of 3,000-10,000 per hour.

Coating is confined to the desired area by two traveling masking strips, while racks, loaded with components, move continuously through the spray station. Components are spun to insure even coating. To simplify handling, components remain in racks for both spraying and baking operations. The magazine will handle racks pre-loaded from a previous operation or empty racks which can be loaded as they emerge.

Model HD-2 can be used in conjunction with a lead straightener, orienting and testing machine, and can be adapted to individual specifications.

Readers' Service Item 27

Dart Drop Impact Tester

Plasti-Dart Model E-35 was designed by Plas-Tech Equipment Corp. to obtain a quantitative measure of absorbed, transmitted, and rebound energy characteristics for elastomers, foams, and other cushioning systems. A dart with removable weights is dropped onto a test specimen mounted over a transducer, whose signal is fed into the Y axis of an oscilloscope. The resulting load-time curve, obtained as an oscilloscope trace, is recorded by a camera attached to the oscilloscope face.

The base of the tester is 30 inches long, 15 inches wide, and ½ inch thick. The shaft on which the electromagnet is mounted is five feet long.

Plasti-Dart impact tester.

Readers' Service Item 28

Plastisol Rotational Molder

Mercury Molding Machinery, Inc., has made available a rotational molding machine for vinyl plastisols. Roto-Molder SD-3/30P features a channel steel frame oven with expansion joint 16-gage panel construction. The combustion chamber is separated from the rotation chamber by a gas-tight panel. Both the main and planetary shafts of the rotation drive are alloy steel. The drive unit, with a horizontal leveling device for mold plate holders, operates from 6-18 rpm at a ratio of 4:1.

Located in a vapor-tight control box are ventilation and temperature controls, a cycle timer, and a signal light push-button station.

The machine is 80 inches deep, 109 inches wide, and 84 inches high. The rotation chamber measures 43 by 63 by 63 inches. Operation requires main drive and

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Emery Industries (Canada), London, Ontario
Export Department, Cincinnati

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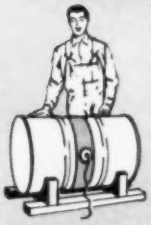

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5 GAL. Drum or straight sided Pail Heater #PH-5—S/W 5 lbs. **$16.75**

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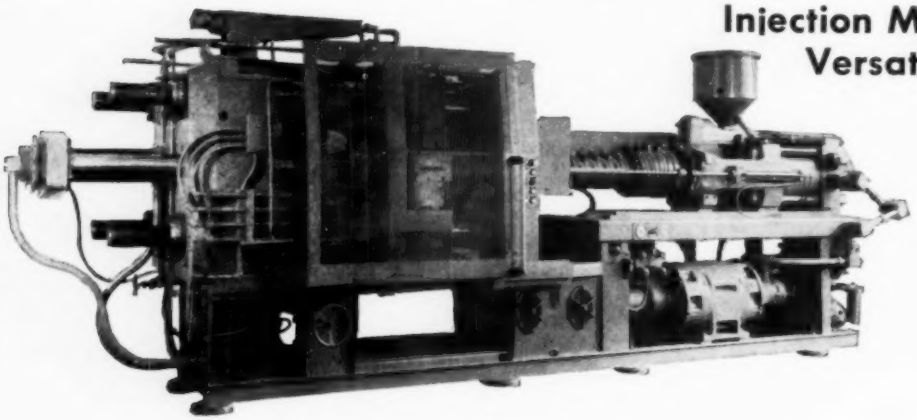

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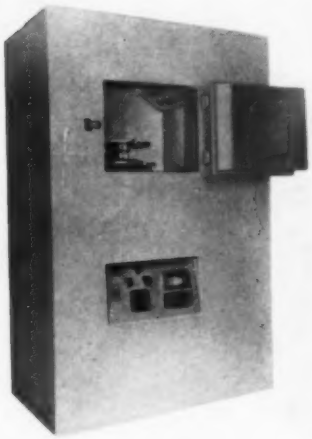


Mercury Roto-Molder Model RML—1E4/1.

recirculating fan motors—three phase, 50/60 cycle, 208/220/440 volt.

Production capacity depends on the number of mold plates per hour. For example, with a six-minute gel and fuse cycle, approximately 18 plates per hour could be produced.

Gang mold holders are for 30 to 42 inches.

Mold clearance at:	15 in. radius	18 in radius	25½ in. radius
Max. mold height, inches	22	18	25
Max. mold diameter, inches	36	36	51

Readers' Service Item 29

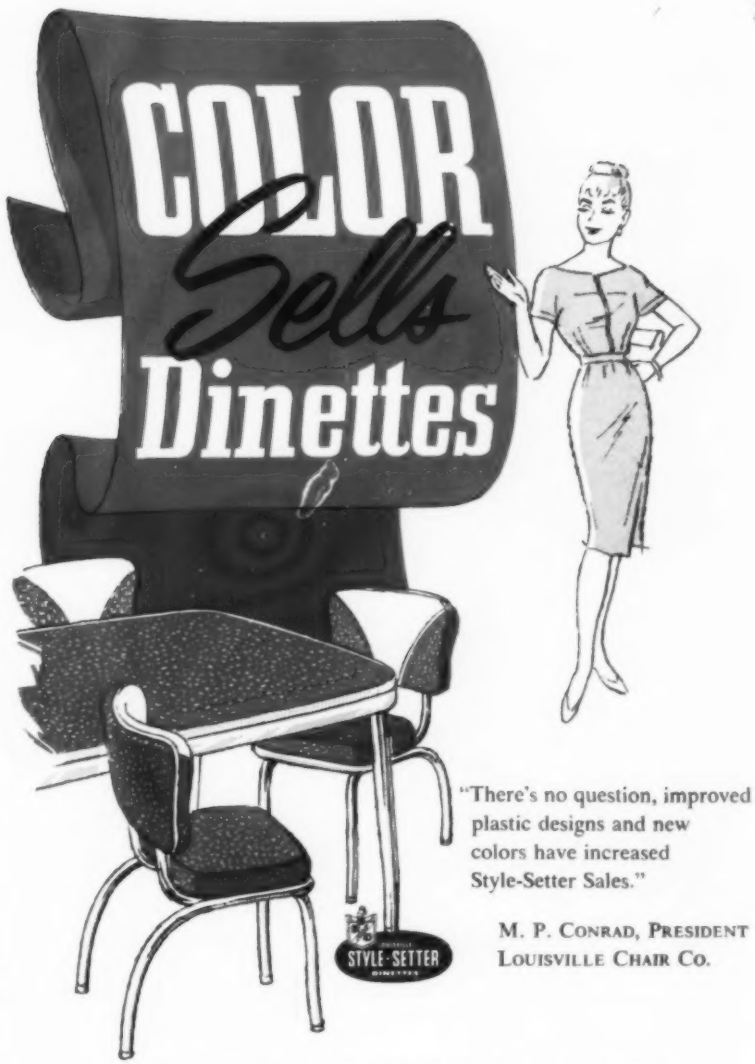
Dot Welder Model D27.

Welding Gun Unit

The Dot Welder, available from Mid-States Welder Manufacturing Co., is useful for repairing die scratches, cavities, and undercuts. A short pulse of high density electrical current in the welder fuses metal pellets into the damaged die without removing it from the machine. Because the electrical impulse is so short, the die need not be pre-heated.

Excess material can be filed or ground off only a few minutes after the carbon steel shot has been fused to the base metal.

Readers' Service Item 30



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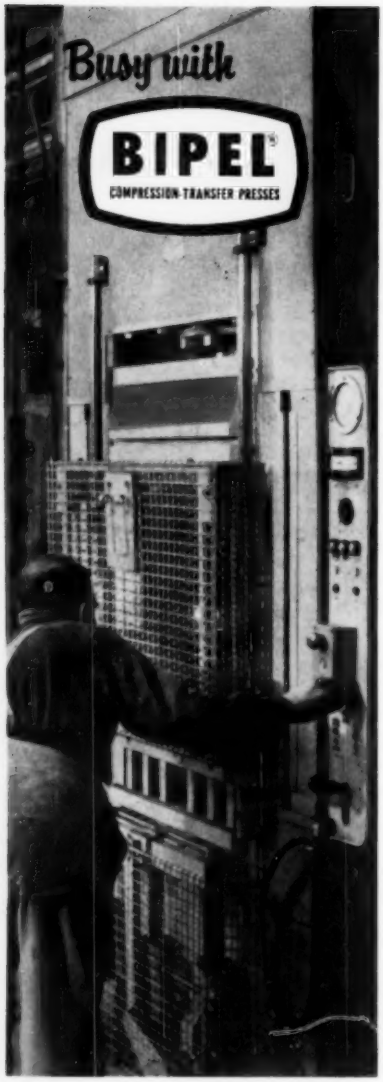

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BIPEL
COMPRESSION-TRANSFER PRESSES
HORIZONTAL HYDRAULIC PREFORMERS

Plastics Applications

Write item numbers on Readers' Service Card (p. 77) to obtain more information.

Chippewa Type-B industrial bag.

Polyethylene Industrial Bag

Chippewa Plastics Co. claims its Type B, thinner-walled industrial bag has improved puncture and snag resistance. The polyethylene film used is 40% thinner than that of the company's original 10-mil bag.

The reduction in gage is expected to reduce bag cost, thereby making the package competitive with standard multi-wall bags. It is especially useful in packaging items requiring a positive moisture barrier.

Readers' Service Item 41

Perma-Seal vinyl stripping.

Vinyl Strap Stripping

Borden Chemical Co. has made available a vinyl strap stripping, Perma-Seal, for use in the shoe and leather industries. Able to withstand temperatures of —50° to 150° F., the material has passed a 100,000-plus flex test and an 85-pound pull strength test without change.

Perma-Seal may be obtained in patent leather or calf finishes, in ¼-, 5/16-, and ⅜-inch widths.

Readers' Service Item 42

Vinyl Sponge Raft-Cushions

Charles Ulmer, Inc., is custom-producing buoyant boat cushions which can be snapped together to form an emergency raft. Developed by U. S. Rubber Co. of its Ensolite vinyl closed-cell foam, the cushions have concealed ring and snap hardware which will not scratch the boat surface.

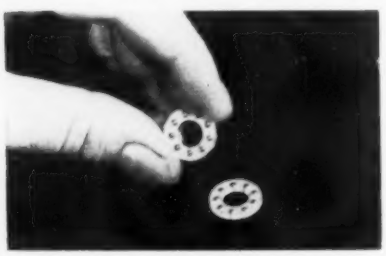
A raft approximately four by eight feet and two inches thick will support two (possibly, up to four) persons. Hand-grips on the sides of the cushions provide support for hangers-on.

Ensolite snapped-together raft.

Readers' Service Item 43

Ball Bearing Retainer

A nylon retainer for steel ball bearings is, according to the manufacturer, Rampe Mfg. Co., more satisfactory technically

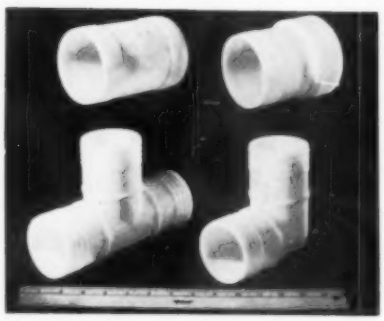


Rampe nylon ball bearing retainer.

than metal. The ring-shaped Plaskon nylon retainer has nine closely positioned holes for the ball bearings. Because the bearings are slightly larger than the holes into which they are pressed, the retainer must stretch and contract during assembly without tightening and preventing free ball rotation.

Allied Chemical Corp.'s Plaskon provided the proper balance of properties, including self-lubrication. The retainer, which upon assembly becomes a thrust bearing, is being used in a worm gear reducer.

Readers' Service Item 44



Insert-type nylon pipe fittings.

Nylon Insert Fittings

Plastiline, Inc., is currently producing insert-type fittings molded of Plaskon nylon in sizes up to four inches. Intended for use on plastic pipes, the high tensile and impact strengths of Plaskon provide the fittings with protection against abuses encountered in installation and use.

Readers' Service Item 45

Experimental laminate speedboat.

Epoxy-Finished Power Boat

Epoxy resins serve two functions in the design of Miss Stars & Stripes, a power boat built as a floating, high-speed research laboratory. Epoxy is used to bond a sandwich of glass fiber cloth between mahogany veneers, forming the hull, and to coat the hull exterior.

In laminating the hull sandwich, Haskelite Manufacturing Corp. spread 1/32-inch of Union Carbide Plastics Co.'s Bakelite Epoxy ERL-2795 over the interior mahogany veneer before applying the glass cloth.

Readers' Service Item 46

Polystyrene Pipe Covering

United Cork Cos. has made available pipe covering of Uni-Crest expanded polystyrene. Because of a low K factor and good moisture resistance, the material should insulate effectively as well as prevent condensation and dripping. A compression strength of 16-20 psi. permits the use of outside hangers without preparation.

Although the material is white, protective paper and foil laminate jackets permit a choice of colors.

Uni-Crest pipe covering is stocked in three standard sizes in regular and self-extinguishing types: light duty, nominal 1 inch for temperatures above freezing; medium duty, nominal 1½ inches for temperatures of 32° F.; and heavy duty, nominal 2 inches for temperatures of 0 to —30° F. Extra thicknesses are available for more severe conditions.

Readers' Service Item 47

Seeder - weeder - feeder Greenmaster lawn spreader.

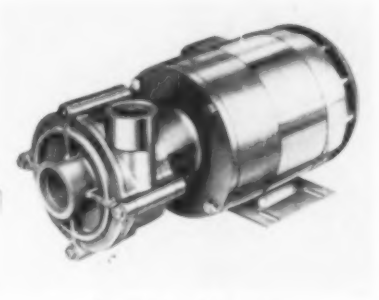
Molded Plastic Lawn Spreader

Federal Tool Corp. is marketing the Greenmaster lawn spreader for applying fertilizer, seed, and weed killer. Corrosion-proof, it may even be used for spreading salt on slippery walks and driveways.

The green hopper, 18 by 12¼ by 7 inches, holds 25 pounds of material. A handle-grip control starts or shuts off the flow, the amount of which is regulated by an adjustment at the left rear of the hopper. The tangerine wheels are bar-tred to prevent slipping.

The lawn spreader requires no oiling. It is acid resistant and will not be damaged by water.

Readers' Service Item 48



Houston Fearless pump.

Centrifugal Pump

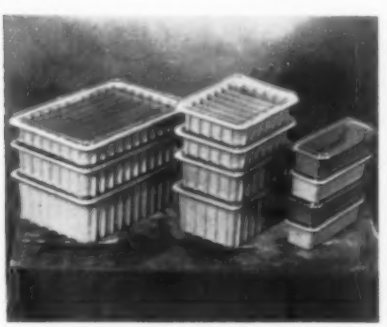
Houston Fearless Corp. is manufacturing a centrifugal pump for continuous duty with certain chemicals and corrosive liquids. With a one-inch outlet, it will deliver up to the practical limit of 33 gpm. at pressures up to 28 feet of head.

The pump body, face plates, and impeller are injection molded of Cycolac ABS resin. Shaft and couplings are 316 stainless steel, O ring is neoprene, and motor case is aluminum. The pump will operate with a single phase or three phase motor.

Readers' Service Item 49

Vacuum-Formed Tote Boxes

Export Corp. has introduced a tote box vacuum-formed from Seilon S-3, a high-impact ABS polymer made by Seiberling Rubber Co.'s plastics division. Featuring a ribbed design which permits installation of dividers, the box comes with a snap-on cover. Seilon has good resistance to chemicals, oils, and solvents, and is non-toxic.



Export's ABS tote boxes.

Readers' Service Item 50

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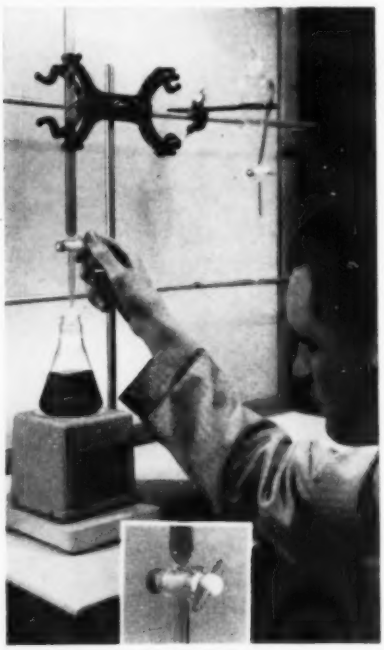
Teflon Stopcock Plugs

The annoyance of frozen stopcocks can be eliminated by using Kimble Glass Co.'s Teflon stopcock plugs. The plug is a complete assembly, with rugged threaded-end fitted with Teflon lock washer and nut to provide a positive load.



Stopcock with Teflon plug.

Encased in polished glass barrels, the plugs require no lubrication. Thus solution contamination is prevented, and equipment maintenance is reduced.

Kimble's plugs are available in its line of Kimax burets, separatory funnels, and stopcocks.

Readers' Service Item 51

Teflon-Glass Conveyor Belts

General Plastics Corp. has developed endless belts of Teflon impregnated glass fabric especially suited for resin conveyors. The non-stick characteristics of Teflon prevent resin buildup in pre-heat ovens and ease cleaning, while the glass base permits the conveyor to resist temperatures over 400° F. The belt may also be used for heat sealing operations.

The belts are available in order in widths to 50 inches. For most applications, 0.010-inch thick fabric has been found satisfactory.

Readers' Service Item 52

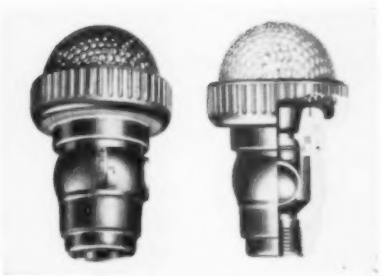
Circular Telephone Booths

Doorless telephone booths, in which sound is trapped by Formica-backed panels, are being distributed by Formica

Formica-Fiberglas-Masonite telephone booth.

Corp. The circular booths consist of a layer of Fiberglas batts sandwiched between inner Masonite pegboard panels and an outer layer of Formica. Each seven-foot booth is held two feet off the floor by three pole legs.

Readers' Service Item 53



Chemtrol plastic foot valve.

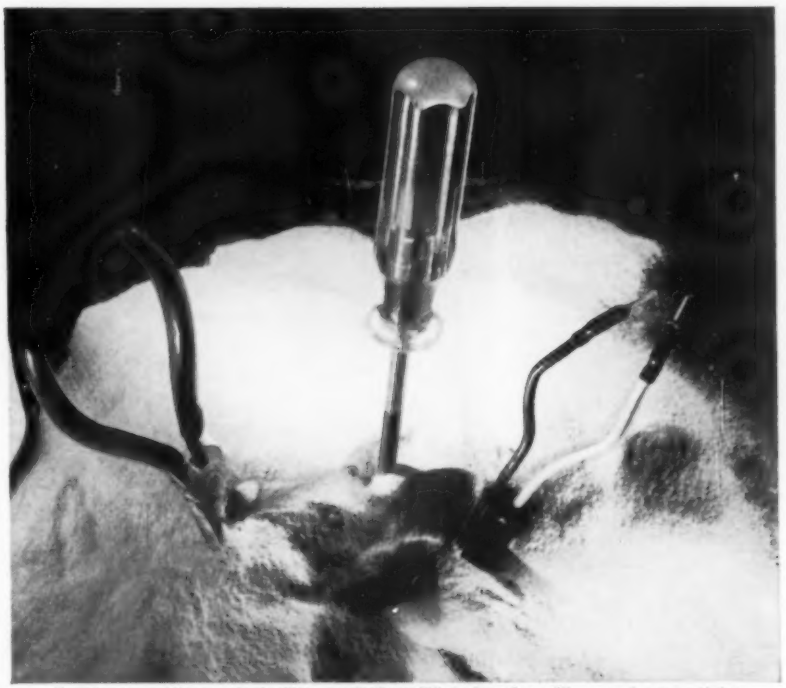
Molded Foot Valve

To its line of plastic valves, Chemtrol has added a foot valve to be used in sumps or tanks where the fluid level must be reduced or the fluid withdrawn. The model is furnished in sizes from ½ to two inches in Type I and Type II PVC. Connectors come in IPS threads or in standard socket dimensions for solvent welding.

The suction end of the valve is protected against debris intake by a hemispherical plastic screen. By removing the threaded screen protector, a ball check valve, which prevents back flow, can be reached. Both seat and ball are removable for cleaning.

The seat is equipped with a quad ring, sealing off leakage between ball and body, and is retained in the body by the screened cap.

Readers' Service Item 54



For clear, sparkling products, this new Du Pont C/A is free from fibers and gel particles

FLAKED CELLULOSE ACETATE

from Du Pont for lacquers and molding powders

Here's a new Du Pont cellulose acetate. It leaves your formulations free from both fibers and gel particles.

Excellent clarity and sparkle. If appearance is important to your product, you'll like the way this new Du Pont C/A adds the clarity and sparkle of fine crystal.

Other properties. Du Pont C/A is tough. It has excellent light-stability characteristics, low flammability, excellent electrical resistance, good solubility. It goes into clear, water-white solutions rapidly. It's free from acidity.

Wide range. You can get this flake over an acetylation range from 52% to 56%, in viscosities stretching from 3 to 150 sec, Du Pont 20% viscosity.

Available in 60-lb. multiwall bags.

For information on pricing and shipping arrangements, call or write Du Pont, Explosives Department, 6539 Nemours Building, Wilmington 98, Delaware, or contact any of the offices listed below.

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—for both paste and liquid finishes—imparting improved wear and durability, water resistance, antislip properties and rebuffability, gloss.

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—hot-melt quality coatings, at low cost; good grease and scuff resistance; single feed to automatic machines.

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—longer shelf life; reduced flaking, leaking and bulging of dairy cartons.

Box Makers

—interior coatings for corrugated cartons that eliminate fibre scratch and need for costly liners; improved scuff, chemical, grease and moisture resistance; better gloss, no rub-off.

Food Packagers

—smarter package appearance—with more gloss, less rub-off and scuff; improves printing on packages at the same time.

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—simplified production, minimum mold costs; tough, colorful moldings with fine detail.

Film Extruders

—faster extrusion, lower machine temperatures, easier gauge control; brilliant, uniformly colored films.

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—glossy finish and even color; faster molding operations.

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Book Reviews

"Hot Organic Coatings." Raymond B. Seymour. Reinhold Publishing Corp., 420 Park Ave., New York 22, N. Y. Cloth, 6¼ by 9¼ inches, 233 pages. Price, $7.50.

After discussing coatings in general, the author proceeds to outline the practical considerations in hot-applying asphalt, coal-tar pitch, waxes, synthetic hydrocarbons, and cellulose derivatives. Concentrating on supplying information of help in selecting and using coatings, he includes detailed tables of physical properties, specifications, chemical and physical resistance, and comparative efficiencies. Directions for formulations of proprietary products are featured.

Methods of applying hot coatings, both in solution and solvent-free, are described and illustrated with case histories. One chapter is devoted to tests for evaluating hot organic coatings.

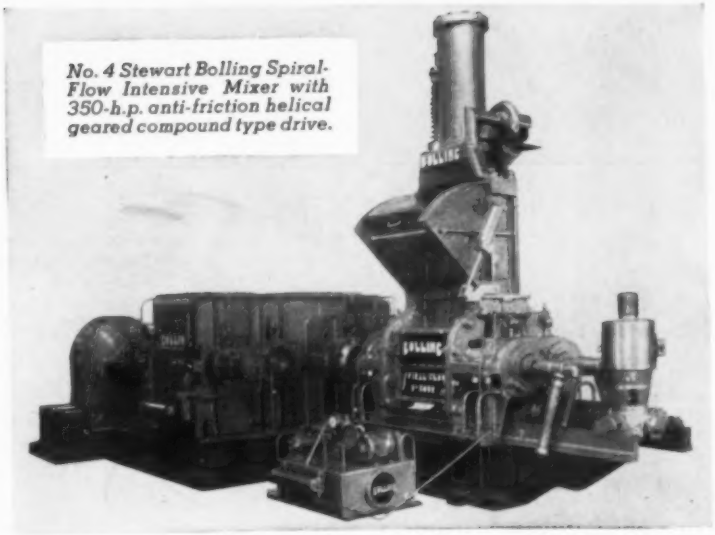
George B. McComb has contributed a chapter on hot-applied coal tar pitch-base coatings.

"Plastics Abstracts." Plastics Investigations, 23 Canonsfield Rd., Welwyn, Hertfordshire, England. Paper, 8 by 10 inches. Price, $70.00 per year (air mail, $98.00 per year); single copies, $1.90.

This weekly journal abstracts British patent specifications and periodical articles dealing with the science, technology, and applications of plastics. Patent information is usually included one week after original publication, while periodical abstracts generally take two weeks. Author, patent, and subject indexes are published annually.

"Technical Papers—1958." Society of Vacuum Coaters, P. O. Box 3095, Cleveland 17, O. Unbound. Price, $10.00.

Papers presented at the fall meeting and technical conference of the Society of Vacuum Coaters, held at the Statler Hotel in Detroit, November 1958, are available as a booklet. Topics are: Methods of High Vacuum Vapor Coating Control; An Analytical Method of Leak Determination in High Vacuum Systems; Maintenance, Operating, and Trouble Shooting Problems in Vacuum Coating Systems; New Trends in Vacuum Coating; The Dip Dyeing of Finishes for Vacuum Metallizing; New Coating Developments in Vacuum Metallizing; and Selection of Oven Equipment for Vacuum Coaters.



No. 4 Stewart Bolling Spiral-Flow Intensive Mixer with 350-h.p. anti-friction helical geared compound type drive.

Thanks to Important Basic Patents,

Bolling SPIRAL-FLOW Intensive Mixers Offer Advantages Obtainable Nowhere Else

AVAILABLE FEATURES:

Variable friction ratios

• • •

Choice of 3 types of drives

• • •

Choice of 3 types of discharge doors

• • •

Chrome-plated interiors

The latest Stewart Bolling patent covers our strip dust seal, copper with lubricant or Nylon without lubricant. We believe this seal to be the *least expensive* and longest wearing in the world. Patented also: the well known Spiral-Flow sides, and interchangeable front-to-back rotors with full-circle end flanges. Likewise exclusive: the Bolling Ultra discharge door, which we believe to be the *least expensive* in its field, as well as the fastest and most positive in opening and closing.

All this is evidence that Bolling Spiral-Flow Intensive Mixers are not reworked rubber machines. Instead, they were designed for processing virgin plastics—for high speeds, high pressures and fast cycling. We believe that they have never been approached in dispersing capacity and long life.

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Speed Reducers • Gears • Extruders

Patent Digest

Materials

Chlorination of Polyester Structure. No. 2,876,185. L. E. Wolinski, Buffalo, N. Y. (to E. I. du Pont de Nemours & Co., Wilmington, Del.).

Treatment of Polyester Structure. Nos. 2,876,186 and 2,876,187. L. E. Wolinski, Buffalo, N. Y. (to E. I. du Pont de Nemours & Co., Wilmington, Del.).

Flame Resistant Polyester Composition Containing a Halogenated Phosphonate. No. 2,877,204. G. B. Duhnkrack, Harrison, and C. H. Dugliss, Yorktown Heights, N. Y. (to American Cyanamid Co., New York, N. Y.).

Surface Treatment of Polyethylene Structures. No. 2,878,519. L. E. Wolinski, Buffalo, N. Y. (to E. I. du Pont de Nemours & Co., Wilmington, Del.).

Production of Vinyl Chloride from Ethylene Dichloride. No. 2,877,277. D. C. G. Gattiker, S. C. Liang, and J. G. D. Schulz, Montreal, Quebec, Canada (to Dominion Tar & Chemical Co., Ltd., Montreal, Quebec, Canada).

Emulsion Polymerization with Polybasic Acid Soap. No. 2,876,203. V. A. Miller, Dover, Del., and R. O. Becker, Syracuse, N. Y. (to International Latex Corp., Dover, Del.).

Wax-Polyethylene-Polyisobutylene. No. 2,876,204. H. G. Schneider and D. W. Young, Westfield, and J. P. Rocca, Linden, N. J. (to Esso Research and Engineering Co.).

Production of Perfluorochloroolefins, No. 2,877,275. J. W. Jewell, Summit, N. J. (to Minnesota Mining and Manufacturing Co., St. Paul, Minn.).

Process for the Preparation of Foamed Polyurethanes. No. 2,879,233. H. A. Pace, Akron, O. (to Goodyear Tire & Rubber Co., Akron, O.).

Dispersion of Fluorochlorocarbon Polymers. No. 2,876,206. I. Green, Roselle, N. J. (to Minnesota Mining and Manufacturing Co., St. Paul, Minn.).

Composition Comprising Cellulose Derivative, Epoxy Resin and Epoxy Curing Catalyst and Process for Preparing Same. No. 2,879,235. F. E. Condo, El Cerrito, Calif. (to Shell Development Co., Emeryville, Calif.).

Phenolic Resin Compositions Containing a Metal Chelate and Glass Fiber Impregnated Therewith. No. 2,876,208. M. Naps, Oakland, Calif. (to Shell Development Co., New York, N. Y.).

Organic Silicon Compounds and Methods for Making Them. No. 2,876,209. P. L. de Benneville, Philadelphia, and M. J. Hurwitz, Elkins Park, Pa. (to Rohm & Haas Co., Philadelphia, Pa.).

Process of Surface Treating Polyethylene Structures and Resultant Article. No. 2,879,177. J. A. Nelson, Jr., Rochester, N. Y. and W. K. Vollmer, Allison Park, Pa. (to Union Carbide Corp.).

Linear Polyester Compositions Containing the Condensation Product of Hydroquinone and Allyl Alcohol as a Heat Stabilizer. No. 2,875,176. De W. S. Young, R. M. Schulken, Jr., and L. D. Moore, Jr., Kingsport, Tenn. (to Eastman Kodak Co., Rochester, N. Y.).

Process for Preparing Organophilic Particulate Solids by Polymerizing Ethylenically Unsaturated Monomers upon the Surface of Organophobic Particulate Solids. No. 2,876,133. R. K. Iler and R. D. Lipscomb, Wilmington, Del. (to E. I. du Pont de Nemours & Co., Wilmington, Del.).

Production of Polyesters by Poly-Addition. No. 2,875,181. G. Faerber, Moers, Germany (to Deutsche Solvay-Werke G. m. b. H., Solingen-Ohligs, Germany).

Work Glove. No. 2,873,450. E. A. Brodeur, Jr., Greenville, R. I. (to U. S. Rubber Co., New York, N. Y.).

Printed copies of patents are available from the Commissioner of Patents, Washington 25, D. C. Prices, 25c each.
—The Editor

Process for Polymerizing Vinyl Chloride in the Presence of Methyl Cellulose Gelatin and Inert Solvent. No. 2,875,186. J. R. Gerhard II, West Lawn, and C. C. Deegan and T. W. Fisher, Jr., Pottstown, Pa. (to Firestone Tire & Rubber Co., Akron, O.).

Process of Making Carbon-Filled Polyamide. No. 2,875,171. S. P. Foster and R. W. Peterson, Wilmington, Del. (to E. I. du Pont de Nemours and Co., Wilmington, Del.).

Method of Polymerizing a Monoethylenically Unsaturated Vinylidene Compound in Aqueous Suspension. No. 2,875,185. R. M. Wiley, Midland, Mich. (to Dow Chemical Co., Midland, Mich.).

Conversion of Thermoplastic Resins to Thermoset Resins. No. 2,875,179. J. H. Freeman, Greensburg, Pa. (to Western Electric Corp., East Pittsburgh, Pa.).

Purification of Vinyl Chloride and a Process Relating Thereto. No. 2,875,586. F. Pohl, Knapsack, near Koln, Germany (to Knapsack-Griesheim Aktiengesellschaft, Knapsack, near Koln, Germany).

Equipment

Mold for Annular Plastic Articles, No. 2,878,517. T. K. Cramer, Crawfordsville, Ind. (to Plastene Corp., Crawfordsville, Ind.).

Rotary Molding Machine. No. 2,875,471. C. M. Crowther, Baltimore County, Md.

Valved Gates for an Injection Molding Press. No. 2,878,515. W. Strauss, Philadelphia, Pa. (to F. J. Stokes Corp.).

Ram for Presses and the Like. No. 2,875,732. O. Hoffmann, Kenmore, N. Y. (to Lake Erie Machinery Corp., Buffalo, N. Y.).

Molding Apparatus for Container Covers. No. 2,875,472. W. Marcus, Cleveland, O.

Automatic Stock Feed into Extrusion Apparatus. No. 2,875,469. B. H. Davis, Noank, Conn. (to Standard Machinery Division, Franklin Research Corp., Mystic, Conn.).

Apparatus for Injection Molding Articles Made of a Thermoplastic. No. 2,876,495. K. W. Spillman, Whittier, Calif. (to Parker Pen Co., Janesville, Wis.).

Apparatus for Producing Thermoplastic Fibers. No. 2,875,893. R. G. Russell, Granville, and E. W. Smart and J. D. Riley, Newark, O. (to Owens-Corning Fiberglas Corp.).

Method of and Apparatus for Treating Surfaces of Thermoplastic Containers by Corona Discharge. No. 2,876,358. A. A. Root, Concord, Mass. (to Bradley Container Corp., Maynard, Mass.).

Apparatus for Molding Plastic. No. 2,876,492. L. P. Frieder, Great Neck, and W. S. Finken, Brooklyn, N. Y. (to L. P. Frieder, Great Neck, N. Y.).

Machine for and Method of Progressively Corrugating Plastic Sheet Material. No. 2,876,824. M. J. West, Shelton, and J. A. Cutarelli, Ansonia, Conn. (to B. F. Goodrich Co., New York, N. Y.).

Applications

Laminated Fluorescent Sign. No. 2,878,606. L. Meijer, Chicago, Ill.

Containers. No. 2,878,848. B. W. Coltman, Jr., Kenilworth, Ill. (to Republic Molding Corp., Chicago, Ill.).

Pre-Molded Box Toe for Boot. No. 2,878,597. J. S. Justin, Jr., Fort Worth, Tex.

Plastic Tank Liners. No. 2,876,927. A. H. Henning, Andover, Mass. (to General Tire & Rubber Co., Akron, O.).

Flexible Bags of Plastic Sheet Material. No. 2,878,849. D. J. Lingenfelter, Glendale, R. D. Grover, Van Nuys, and C. A. Forbes, Jr., Los Angeles, Calif. (to Polyfab Co., Los Angeles, Calif.).

Resinous Plastic Pirn. No. 2,879,010. T. G. Crawford, Hampton, S. C. (to Westinghouse Electric Corp., East Pittsburgh, Pa.).

Polyethylene Bottle. No. 2,876,818. A. M. Raff, Cheltenham, and E. V. Svedres, Ambler, Pa. (to Smith, Kline & French Laboratories, Philadelphia, Pa.).

Plastic Cast Ring Stack Transducer. No. 2,879,496. L. W. Camp, State College, Pa. (to Research Corp., New York, N. Y.).

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Abstracts of Important Articles

Materials

"The Induction of Electrical Conductivity in Irradiated Polymers," L. Holland, *Plastics (London)*, 24, 258, 112 (March 1959).

After briefly sketching some of the general effects of radiation on different polymers, the author reviews the literature on induced electrical conductivity. He deals with the mechanism of conduction in irradiated plastics, and points to the need for further investigations on materials of known polymerization and purity before a wholly satisfactory theory of conduction in polymers can be developed. He considers the changes caused by irradiation in properties of surfaces which may become hydrophilic. Here, also, further research is required.

"Some Aspects of Long-term Tests on Polyester Resin/Glass Laminates," A. de Dani and K. J. Brookfield, TRANS. PLASTICS INST., 27, 69, 94 (June 1959).

Long-term tests are necessary to determine the suitability of polyester resin/glass laminates for load-bearing applications which may require a service life of 30 years or more. The authors refer to work in this direction by other investigators as well as to their own work. They point out that there is a reasonable amount of information on long-term strength up to 1,000 hours, and a little on strengths up to 3,000 hours, but that it will require accumulation of much experience and many more test results to bridge the gap from 3,000 hours to a life of 30 years.

"Developments in Condensation Polymers," R. J. W. Reynolds, TRANS. PLASTICS INST., 27, 68, 44 (April 1959).

The developments that have taken place in polyamides, polyesters, polyethers and polyurethanes are reviewed with the object of indicating the direction that future progress may be expected to take.

"The Use of Plastics Materials in Electric Cables and Associated Products," J. D. S. Hinchliffe, TRANS. PLASTICS INST., 27, 68, 30 (April 1959).

After discussing the properties of the various plastics used in cable manufacture and the manufacturing techniques employed, details are given of the main types of plastics-insulated cables in present use. Included are cables for mains wiring, power supply, aircraft wiring, railway signaling, telephone systems, radio and television relaying, radio-frequency applications, and television camera cables. Joints, repairs, and accessories for cable terminations are briefly mentioned. Attention is called to the special needs for cable in connection with the increasing trend toward miniaturization of electronic equipment, and to the future requirements for cable for higher operating temperatures.

"Painting Versus Molding in Color," T. E. Hayden, SPE J., 16, 1, 84 (Jan. 1960).

A basic comparison of costs for painting and molding in color.

In the reference system used, the first number following the magazine name is the volume number, the second is the issue number (if any), and the third is the first page on which the abstracted article appears in that magazine.

Request for copies, reprints, or further information on any article abstracted in this department should be addressed to the publisher of the magazine where the article appeared. A complete listing of the publishers and addresses of these magazines is printed here quarterly.

The next complete listing will appear in June. The last listing appeared in the February issue.

"Hostalen PPH—Low Pressure Polypropylene for Injection Molding," A. Schley and F. Schulden, *Kunststoffe*, 49, 3, 102 (March 1959).

Hostalen PPH is the first low-pressure, isotactic polypropylene specially developed by Farbwerke Hoechst for injection molding. Recently, a type, Hostalen PPN, has been added which has lower molecular weight than PPH, hence better flow properties, but otherwise differs little from it. Their properties are described, particularly the thermal qualities. It is explained how mechanical properties and shrinkage are affected by temperature and unsuitable processing methods, and how the most favorable conditions for injection molding can be achieved. A number of applications are shown. (In German.)

"Improved Properties of Glass-Reinforced Plastics and Methods of Testing Them," H. Hagen, *Kunststoffe*, 49, 3, 127 (March 1959).

Some of the improvements resulting from recent developments in resins and fiber glass reported at an American convention held in 1958 are discussed, and testing methods that were employed are described. (In German.)

"Mechanism and Mechanics of Creep of Plastics," W. N. Findley, SPE J., 16, 1, 57 (Jan. 1960).

Part I of a two-part article on creep of plastics.

Applications

"The Principles of Rotary Molding," J. C. Reib, *SPE J.*, 15, 7, 546 (July 1959).

A 15th Antec paper covering the method for rotary molding.

"Plastics for Duplicate Die Models, Prototype Tools, Engineering Checking Fixtures," J. T. O'Reilly and H. L. Wyatt, *Plastics Industry*, 17, 6, 24 (June 1959).

A brief description of uses made by Ford Motor Co.

Rigid Polyurethane Foams in the Building Industry," T. L. Phillips, *Brit. Plastics*, 32, 1, 20 (Jan. 1959).

After reviewing the different types of polyurethane foams available, as well as formulations, mixing, and curing, the author discusses the important properties which together with new *in situ* manufacturing techniques make them particularly useful in the building industry for thermal insulation, sound absorption, and where high strength-weight ratio is required. A table compares some physical properties of the polyurethane foams with those of other rigid foams.

"High-Density Polyethylene Protective and Functional Coatings," S. E. Hmiel and H. G. Guy, *SPE J.*, 15, 7, 540 (July 1959).

A practical method for application of H-D polyethylene to metals is described.

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"Construction of Outdoor Signs from Butyrate sheet," R. O. Hill, Jr., *Western Plastics*, 6, 7, 19 (July 1959).

A report dealing with forming and fabricating, and decorating of butyrate signs for outdoor use.

"Plastics and Passenger Transport," J. D. Mundella, *Plastics Inst. Trans.*, 27, 69, 97 (June 1959).

The problems and advantages of polyester resin/glass materials on vehicles for public transportation are discussed, and a possible form of vehicle construction is outlined.

"The Application of Reinforced Plastics to the Chemical Industry," R. S. Ogg, *Rubber & Plastics Age*, 40, 2, 168 (Feb. 1959).

The present position of reinforced plastics in the chemical industry is outlined, and the need emphasized for more research on resin/glass combinations under stress and chemical attack, in order to insure wide acceptance of these resins in the industry.

"Some Problems in the Use of High Frequencies for Welding," R. E. Bazin, *Plastics (London)*, 24, 257, 58 (Feb. 1959).

The limiting factors in the use of high frequencies for welding, and the development of Acme machines to overcome these, are discussed. Referring to future limits that the Government may impose on radiation as a result of recommendations by a Committee appointed in 1957 to study the problem of radio interference, the author suggests that the industry may have to use screened booths or rooms in which the equipment would be completely enclosed. Appended is a description of the latest Acme machine.

"Apparatus for Quadratic Measurement of Ionization," A. Richard, *Ind. Plastiques Mod.*, 11, 2, 49 (Feb. 1959).

Description of an apparatus and method for measuring internal discharges in insulation materials. (In French.)

"Applications of Large Nylon 6 Extrusion Castings," C. J. Paquette and J. H. Myers, SPE J., 16, 1, 33 (Jan. 1960).

Suggested uses are propellers, warbler couplings, industrial truck wheels, large gears, outboard motor sections, and cast slabs.

"Plastics as Friction Materials," G. Fabre, IND. PLASTIQUES MOD., 11, 8, 40 (July-Aug. 1959).

After discussing the mechanical, chemical and thermal properties required of plastics for use in bearings, the author examines the friction characteristics of phenolics, polyamides, and PTFE. At the same time, he describes applications. (In French.)

"Materials for Gaskets, Packings and Seals," R. J. Fabian, MATERIALS DESIGN ENG., 50, 7, 111 (Dec. 1959).

A review of the materials and composites available for sealing uses.

"Aluminum-Foamed Plastic Panels," L. W. Hovland and E. R. McLaughlin, SPE J., 15, 12, 1066 (Dec. 1959).

Core sandwich materials are shown to be suitable.

"Epoxy Resins for the Encapsulation of Electronic Components," A. F. Ringwood, SPE J., 16, 1, 93 (Jan. 1960).

Properly-formulated epoxy compounds are shown to be satisfactory for electronic encapsulations.

"The Cook-In Pouch—New Applications for Plastics Films," F. B. Shaw, SPE J., 16, 1, 75 (Jan. 1960).

A one-page discussion of these flexible packages.

"Reinforced Plastics for High Temperature Service in Rocket Engines," George Epstein and J. C. Wilson, PLASTICS INDUSTRY, 6, 12, 23 (Dec. 1959).

How the properties of reinforced plastics make them suitable for use as insulation materials.

"Low Molecular Weight Polyethylenes in Paperboard Coatings," Robert Rosenbaum, SPE J., 16, 1, 90 (Jan. 1960).

A short comparison of paraffin and polyethylene in paperboard coatings.

General

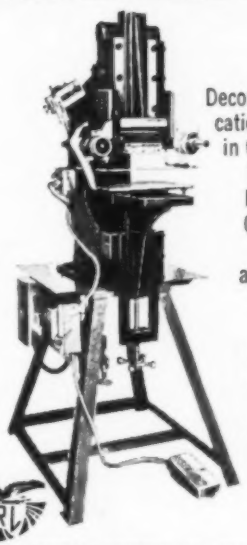
"Plastics Research in Poland," Jerome Formo, *SPE J.*, 15, 10, 858 (Oct. 1959).

A brief review of progress made by Poland in the field of plastics.

"International Competition in the Chemical Industry," S. P. Chambers, *Plastics Inst. Trans.* 27, 69, 76 (June 1959).

This, the Tenth Annual Lecture of the Plastics Institute, presents an analysis of chemical production in the free world, the distribution of world exports, and the factors which affect the significance of export figures. The position of plastics exports is studied and the importance of exports to Iron Curtain countries is emphasized.

PLASTIC MARKING



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Elftex 3, 5, 8	lb.	.0875/ .16
Monarch 81	lb.	.1125/ .20

Fillers

Wollastonite P-1	ton	29.00 / 34.00

Plasticizers

Harchem butyl stearate	lb.	.2525/ .3425
Caprylalcohol	lb.	.195 / .30
Caprylene	lb.	.10 / .205
Harchemex	lb.	.24 / .345
Harflex 10	lb.	1.28 / 1.37
40	lb.	.655 / .745
50	lb.	.5925/ .6825
90	lb.	.91 / 1.00
110, 140	lb.	.285 / .40
120, 150, 180	lb.	.25 / .39
130	lb.	.255 / .395
160	lb.	.30 / .395
220, 250	lb.	.40 / .495
300	lb.	.58 / .675
325	lb.	.4325/ .52
330	lb.	.4425/ .5325
375	lb.	.7425/ .83
500	lb.	.315 / .41
Methyl hexyl ketone	lb.	.26 / .365
Sebacic acid, CP	lb.	.695 / .815
Purified	lb.	.655 / .775

Resins and Molding Compounds

Phenolic

Fiberite 1330, 1346-X337	lb.	.45 / .48
1333A	lb.	.78 / .80
1346	lb.	.52 / .56
1365	lb.	.46 / .49
1982	lb.	.72 / .755
4030-190	lb.	.95 / 1.13
17844	lb.	.4975/ .5275
MX-1344-67, MX-2625	lb.	9.50 / 15.00
MX-1370	lb.	4.00 / 6.00
MX-1801	lb.	3.60 / 6.00
MX-2222-67	lb.	6.90 / 7.00
MX-2549	lb.	7.00 / 9.00
MX-6500	lb.	2.50 / 2.75
OPX-197	lb.	1.50 / 1.74
X2858	lb.	.59 / .63

Polyester

Hetron 17	lb.	.585 / 1.00
19	lb.	.50 / .915
31	lb.	.44 / .855
32A	lb.	.435 / .85
72	lb.	.48 / .895
92	lb.	.43 / .845
93LS	lb.	.485 / .90
103	lb.	.835 / 1.25
301	lb.	.38 / .795
353	lb.	.36 / .775
354	lb.	.35 / .765
PR-135	lb.	.36 / .775

CALENDAR of COMING EVENTS

March 30-31
Plastics Institute. Conference on Polymeric Progress. William Beveridge Hall, London University, London, England.

April 4-7
American Management Association National Packaging Exposition. Convention Hall, Atlantic City, N. J.

April 5-7
Building Research Institute Spring Conferences: Plastics Information Workshop. Statler-Hilton Hotel, New York, N. Y.

April 7-8
SPI Seventeenth Annual Western Section Conference. New Riviera Hotel, Palm Springs, Calif.

April 20
SPE North Texas Section RETEC. Plastics in the Petroleum and Chemical Industries. Hotel Texas, Fort Worth, Tex.

April 20-21
SPI Cellular Plastics Division Automotive Conference. Statler Hotel, Detroit, Mich.

April 20-22
SPI Third Annual Fluorocarbons Division Meeting. Hotel Roosevelt, New Orleans, La.

April 25-26
SPI Eighteenth Annual Canadian Section Conference. London Hotel, London, Ont., Canada.

May 14-29
Foire de Paris. Sixth Exposition of Plastics Materials and Rubber. Parc des Expositions, Paris, France.

May 20-31
Norsk Plastforening. International Plastics Exhibition. Oslo, Norway.

May 23-26
ASME Design Engineering Conference and Show. Statler-Hilton Hotel, New York, N. Y.

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Domestic Production and Sales of Plastics and Resin Material, October and November, 1959

Following are the partly estimated and revised statistics for the domestic production and sale of plastics and resinous material during the months of October and November, 1959. Units listed are in pounds, dry basis unless otherwise specified. Data on alkyds and rosin modifications have not been included since their use is primarily limited to the protective coating industry.

	October, 1959		November, 1959	
	Production	Sales	Production	Sales
Cellulose Plastics:				
Cellulose acetate and mixed ester:				
Sheets, under 0.003 gage	1,545,809	1,498,095	1,689,668	2,021,246
Sheets, 0.003 gage and over	1,829,111	1,798,222	2,230,932	2,194,670
All other sheets, rods, and tubes (including other cellulose plastics)	811,692	866,919	785,107	995,697
Molding and extrusion materials (including other cellulose plastics)	8,876,780	8,788,841	9,518,807	9,572,189
Nitrocellulose sheets, rods, and tubes	246,769	164,700	243,376	162,357
TOTAL	13,310,161	13,116,777	14,467,890	14,946,159
Phenolic and Other Tar-Acid Resins:				
Molding materials[1]	20,247,773	18,242,820	20,326,249	18,589,853
Bonding and adhesive resins for—				
Laminating (except plywood)	7,151,065	5,075,319	6,364,169	4,310,003
Coated and bonded abrasives	1,436,373	1,342,443	1,372,427	1,101,391
Friction materials (brake linings, clutch facings, and similar materials)	1,451,630	1,393,838	1,625,955	1,389,268
Thermal insulation (fiber glass, rock wool)	4,370,782	4,620,433	4,251,726	3,983,367
Plywood	5,959,444	4,846,906	4,903,657	3,931,403
All other bonding and adhesive uses	5,289,883	5,309,431	6,434,063	5,430,031
Protective-coating resins unmodified and modified except by rosin	2,271,694	1,690,688	2,421,561	1,893,445
Resins for all other uses	4,081,231	3,897,202	4,653,373	4,344,423
TOTAL	52,259,875	46,419,080	52,353,180	44,973,184
Urea and Melamine Resins:				
Textile-treating and textile-coating resins	2,687,613	2,425,608	2,481,115	2,665,517
Paper-treating and paper-coating resins	2,571,655	2,274,032	2,395,195	2,271,172
Bonding and adhesive resins for—				
Laminating	3,494,265	2,611,288	3,880,916	2,755,540
Plywood	9,002,997	9,979,844	9,122,645	9,176,929
All other bonding and adhesive uses	1,780,746	1,875,477	2,149,995	1,750,707
Protective-coating resins, straight and modified	3,713,943	2,737,888	3,427,563	2,430,901
Resins for all other uses, including molding	11,513,536	10,446,441	12,974,042	11,000,413
TOTAL	34,764,755	32,168,578	36,431,471	32,051,179
Styrene Resins:				
Molding and extrusion materials:				
Straight polystyrene	23,973,549	22,782,258	25,276,020	23,793,740
All other	34,217,064	28,908,149	35,790,908	31,461,795
Protective-coatings	6,860,122	6,313,492	6,834,509	5,544,457
Textile and paper treating and coating resins	5,444,208	4,219,125	6,835,538	3,920,449
All other uses	12,194,101	15,496,167	11,035,711	15,530,876
TOTAL	82,689,044	77,719,191	85,772,686	80,251,317
Vinyl and Vinyl Chloride Resins:				
Polyvinyl chloride and copolymer resins (50% or more PVC) for—				
Film (resin content)		7,112,128		8,637,553
Sheeting (resin content)		11,274,858		12,604,462
Molding and extrusion (resin content)		28,105,736		30,837,749
Textile and paper treating and coating (resin content)		6,386,877		4,898,325
Flooring (resin content)		11,938,540		14,211,979
Protective coating (resin content)	2,004,356	2,004,356		2,926,966
All other uses (resin content)		7,644,301		8,615,210
All other vinyl resins for—				
Adhesives (resin content)		5,166,864		5,715,887
Protective coatings (resin content)		2,075,119		2,455,945
All other uses (resin content)		9,464,512		10,966,123
TOTAL	98,924,036	92,073,291	105,558,047	101,870,199
Coumarone-Indene and Petroleum Polymer Resins	23,062,745	24,114,973	23,915,787	22,885,844
Polyester Resins:				
For reinforced plastics	9,300,784	8,483,025	9,325,599	8,307,125
For all other uses	1,752,509	1,692,826	1,685,173	1,670,401
TOTAL	11,053,293	10,175,851	11,010,772	9,977,526
Polyethylene Resins:				
For film and sheeting		29,617,149		31,688,358
Molding materials		18,761,354		19,721,034
Extrusion materials		12,987,017		15,126,125
For all other uses		41,499,604		30,592,989
TOTAL	104,615,636	102,865,124	109,337,875[1]	97,128,506[2]
Epoxy Resins:				
For protective coatings		1,829,832		1,963,385
For all other uses		1,871,540		2,190,469
TOTAL	4,970,453	3,701,372	5,368,174	4,153,854
Miscellaneous Synthetic Plastics and Resin Materials, Including Silicone Resins	22,779,507	18,200,366	20,305,676	17,667,253
GRAND TOTALS	448,429,505	420,454,703	464,521,558	425,905,021

[1] 8.9% produced by the low-pressure process.
[2] 10.8% produced by the low-pressure process.
SOURCE: United States Tariff Commission, Chemical Division.

INDEX TO ADVERTISERS*

MARCH 1960

Acra Electric Corporation 62
Agency: R. W. Sayre Company

Argus Chemical Corporation 8
Agency: Geer Du Bois & Company Incorporated

Barber-Colman Company 6
Wheelco Instruments Division
Agency: E. R. Hollingsworth & Associates

B.I.P. Engineers, Ltd. 64
Agency: The Williams Company

Cadet Chemical Corporation 62
Agency: Herbert Margrill Advertising

Catalin Corporation of America 1
Agency: Walter J. Gallagher, Advertising

Celanese Plastics Company 5
A subsidiary of Celanese Corporation of America
Agency: Ellington & Company, Incorporated

Detroit Mold Engineering Company 28
Agency: La Rue-Cleveland, Incorporated

E. I. Du Pont de Nemours & Company 67
Explosives Division for Cellulose Acetate
Agency: The Rumrill Company, Incorporated

Frank W. Egan & Company 14
Agency: Johnson-Bartnett

Emery Industries, Incorporated 60-61
Agency: Farson, Huff & Northlich, Incorporated

Enjay Company 9-10-11-12
Plastics Division
Agency: McCann-Erickson

General Color Company 58
Division of H. Kohnstamm & Company, Incorporated
Agency: The Zlowe Company, Advertising

The Glidden Company 19
Industrial Paint Division
Agency: Meldrum & Fewsmith, Incorporated

B. F. Goodrich Chemical Company ..... Third Cover
Agency: The Griswold-Eshleman Company

The Harshaw Chemical Company ..... Fourth Cover

Hartig Extruders 3
Agency: Sanger-Funnell, Incorporated

Improved Machinery 62
Agency: Hillsborough Advertisers

Industrial Research Laboratories 58
Agency: Boylhart, Lovett & Dean

Injection Molders Supply 23
Agency: Industrial Merchandising Specialists

Kentucky Color & Chemical Company 63
Division of The Harshaw Chemical Company
Agency: Kentuckian Advertising, Incorporated

Monsanto Chemical Company 26-27
Organic Division
Agency: Gardner Advertising

National Lead Company 15
Agency: Marschalk and Pratt, Division of McCann-Erickson

Peerless Roll Leaf Company 73
Agency: Gordon-Pilling

Chas. Pfizer & Company, Incorporated
Chemical Sales Division 29
Commercial Sales Division, Commercial Development Dept. 57
Agency: MacManus, John & Adams, Incorporated

Plastics Engineering Company 7
Agency: Kuttner & Kuttner, Incorporated

The Quaker Oats Company 13
Chemical Division
Agency: Headen, Horrell & Wentsel, Incorporated

Reichhold Chemicals, Incorporated 55
Agency: MacManus, John & Adams, Incorporated

Semet-Solvay, Petrochemical Division, Allied Chemical Corporation 68
Agency: Benton & Bowles, Incorporated

Shell Chemical Company ..... Second Cover
Agency: J. Walter Thompson Company

Silicones Division, Union Carbide Corporation 71
Agency: J. M. Mathes, Incorporated

Stewart Bolling & Company, Incorporated 69
Agency: C. A. Reese Industrial Publicity

F. J. Stokes Corporation 24
Agency: The Aitkin-Kynett Company, Incorporated

U. S. Industrial Chemicals Company 17-18
Agency: G. M. Basford Company

U. S. Mica Company 72
Agency: Terrill Belknap Marsh Associates

Union Carbide Plastics Company 20-21
Agency: J. M. Mathes, Incorporated

Welding Engineers, Incorporated 30
Agency: John Miller Advertising Agency

West Instrument Corporation 66
Agency: Klau-Van Pieterson-Dunlap, Incorporated

Whitlock Associates, Incorporated 53
Agency: La Rue-Cleveland, Incorporated

C. K. Williams & Company 56
Agency: William A. Hatch, Incorporated

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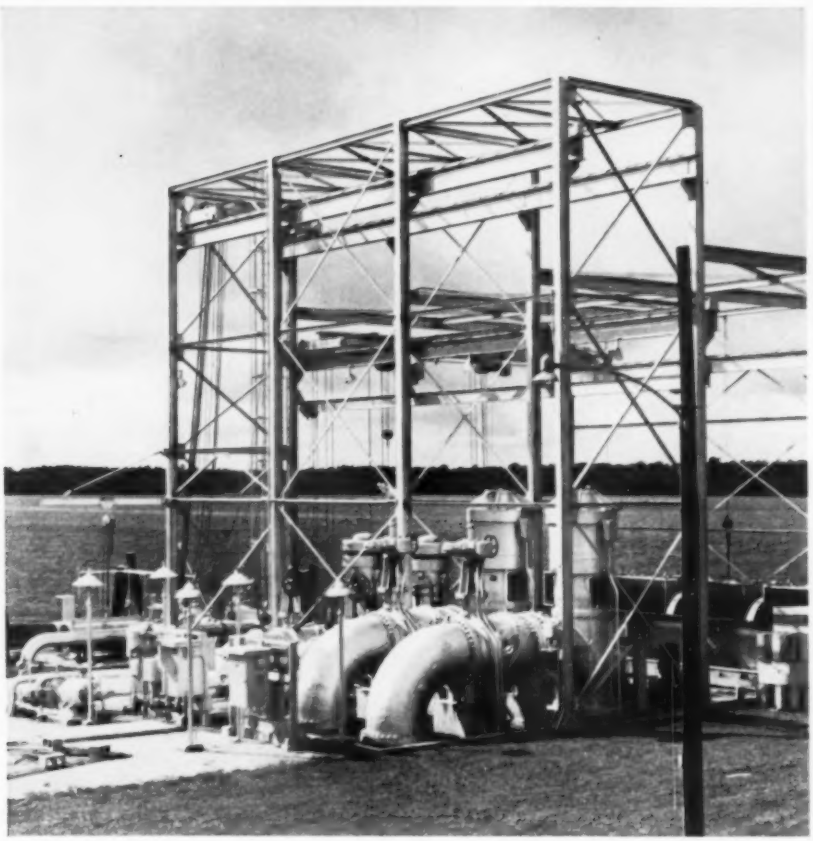
B.F.Goodrich Chemical *raw materials*



Florida Power & Light Company uses anode racks made of Geon vinyl pipe manufactured by Colonial Plastics, Cleveland, Ohio, fabricated by Southeast Distributing Company, Miami. B.F.Goodrich Chemical Company supplies the rigid Geon vinyl. These photos show intake structure at Palatka plant on St. John River, one of many places anode racks of Geon are used.

FP&L fights underwater corrosion with anode racks of rigid GEON

Underwater steel structures corrode when they are attacked by ground currents. Florida Power & Light engineers solve the problem two ways. They reduce effect of ground currents with an opposing voltage, and they suspend anodes of magnesium to bear the brunt of any continuing flow. These anodes rest in frames made of rigid Geon pipe.

Vertical side frames are 1¼" Geon pipe and trays are open sections of 8" pipe. The only effect on the racks of Geon is the marine growth shown in the photo at upper right. This growth is easily washed off, as photo at lower right shows.

Here's another example of the way Geon vinyl can solve corrosion problems for utilities. As pipe, as conduit, or as coatings, you'll find Geon vinyl is often the answer to your corrosion problems. For more information, write Dept. GL-2, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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